APR 23 1917
UNIV. OF MICH. LIBRARY

Engineering and Mining Journal

With which is consolidated Mining and Engineering World

Volume 103, No. 16
Issued Every Saturday
McGraw-Hill Publishing Co., Inc.

NEW YORK, APRIL 21, 1917

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

Remember—

It Costs Little More to Operate a Steam Shovel Than a Hand Shovel—

Astonishing at first thought, isn't it? But what of it? This:

When you are considering the purchase of hand shovels don't think of your storehouse and so many combinations of wood and metal, tied a half dozen to a bundle and standing idle in a corner. Don't fall into that error. On the contrary, think of the hand shovel on the job where every shovel has to have an operator who gets $2.50 per day and up.

Your job is to get the biggest return you can for that daily wage. In order to do it you have to give the shoveler the best shovel you can find anywhere.

Think what it means to pay $2.50 up per day to operate a badly worn shovel and, on the other hand, what it saves to use such a long-service shovel that it skips two wearing-out periods.

Red Edge Shovels are these long-service shovels.

Write and ask for Catalog.

The Wyoming Shovel Works
Wyoming, Pa.

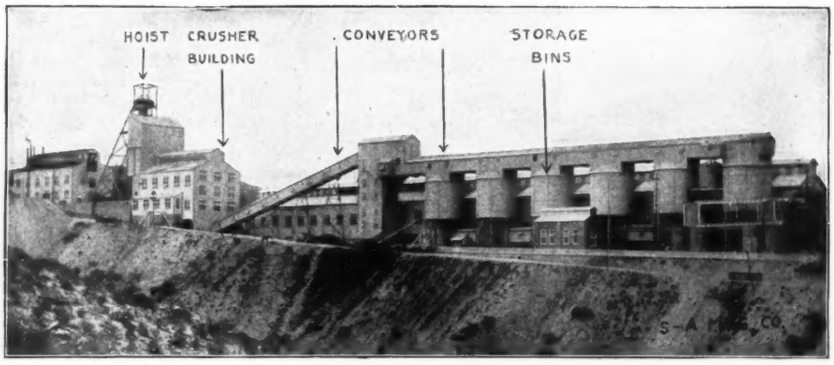
These are the shovels with the chrome nickel steel blades that keep their edges intact — giving a full bladed efficiency during three and four wearing-out periods of ordinary shovels.

WYOMING-MAYARI
RED EDGE
SHOVELS

The S-A Page

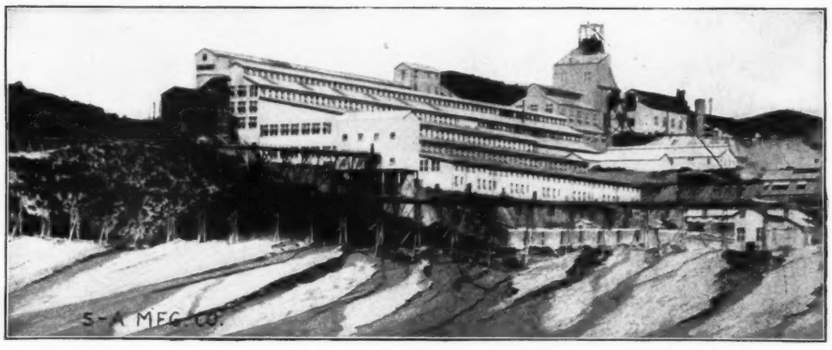
Published Weekly in the Interests of S-A Conveying Engineering

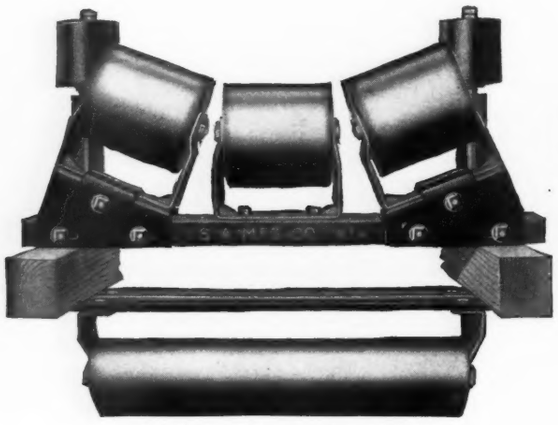
Working Low Grade Ores at a Greater Profit



The illustration shows one of the largest concentrators in the country. More than 3000 tons of ore are treated daily.

Handling costs are maintained at the minimum by the extensive application of "S-A" Equipment which elevates and conveys every ton of ore treated.





"S-A" Unit Carrier

Saves power—saves belts—saves lubrication.

"S-A" UNIT CARRIERS

(PATENTED)

are used on all belt conveyors in the plant.

The Unit Carrier operates on dust-proof ball bearings that cut down the friction to the last possible ounce; and do not require relubrication more than once in six months under the worst conditions.

They are constructed of steel throughout, possessing maximum strength without excessive weight. Extremely flexible, being adapted for all conveying requirements and insuring the least possible belt wear.

The S-A Engineers would be pleased to help you solve any handling or conveying problem for your mill. Consult them now. No charge or obligation.

Ask us to put your name on our mailing list for "The Labor Saver," a free monthly magazine full of live interest to the mine and mill man.

Stephens-Adamson Mfg. Company - Aurora, Illinois

Conveying, Screening, Transmission Machinery

Branch Offices:

50 Church St., NEW YORK
First National Bank Bldg., CHICAGO
79 Milk St., BOSTON, MASS.
H. W. Oliver Building, PITTSBURGH
803 New Bank of Commerce Bldg., ST. LOUIS, MO.
1st Nat'l Bank Bldg., HUNTINGTON, W. VA.
824 Dime Bank Bldg., DETROIT, MICH.
310 Star Bldg., TORONTO, CANADA
412 East Third St., LOS ANGELES
503 Dooly Block, SALT LAKE CITY

Australian Agent—Arthur Leplastrier & Co., Circular Quay East, Sydney.
South African Agent—J. Mac G. Love & Co., Limited, 1 and 3 London House, Loveday St., Johannesburg

Engineering and Mining Journal

VOLUME 103 APRIL 21, 1917 NUMBER 16

Clay County Graphite District of Alabama

By Irving Herr*

SYNOPSIS—Reasons for the necessity for utilizing the domestic supplies of graphite rather than relying on imports are given, together with the effect of the European War on this industry. The metallurgy of graphite is dealt with in detail, and suggestions are made toward improving the treatment of the ore to produce a high-grade graphite with less loss in residue. The extraction with existing methods amounts to about 50% of the graphite in the ore.

There are few industries in the United States that have not been materially affected directly or indirectly by the great European conflict. Some have been much in the public eye; others, buried one might say in the backwoods, have blossomed unseen and unknown except to a small local coterie of interested parties.

The Clay County graphite industry is one of the latter. During the last year it has developed into a husky, black-infant industry. The graphite is as black as those who work in the mills, some of whom were born black, while others are naturally white but are coated with graphite dust until it is hard to distinguish them from the bona fide negroes. The section of Alabama in which Clay County is situated is known as the "black belt," on account of the preponderance of the negro population. It might also have derived the name from the large veins of graphite ore that traverse it for miles.

The boom in graphite struck Clay County about six months ago, as the result of a steady increase from a normal price of about 7c. per lb. for good No. 1 flake, to a maximum of about 18c., and averaging between 14 and 17c. The cause of this rise was an increasing call for the commodity by the various crucible manufacturers, who were unable to turn out graphite crucibles fast enough to supply the demand put upon them by the crucible-steel and brass foundries. Added to this was the impossibility of getting Ceylon and Madagascar graphite, which in normal times furnishes the major portion of the graphite used in this country. During the six years, 1910 to 1915, the average annual importation of graphite into the United States was 24,256 short tons. The entire production of the country for the same period was 4256 tons a year. Of the total amount imported more than half was brought from Ceylon. With the Ceylon

THE 400-TON MILL OF THE GREISMER GRAPHITE CO., ASHLAND, ALA., NEARING COMPLETION

*General superintendent, Crucible Flake Graphite Co., Ashland, Ala.

product unobtainable and the demand for graphite continually increasing, the result was natural.

Instead of the Clay County producer sallying forth to hunt a market for his much-despised product, the crucible manufacturers began to send buyers into the district and prices went up. A year ago there were but three mills operating in the district. Now there are six, and at least a dozen more are in course of construction. Some of these are in the initial stages, while a few are almost completed.

Ashland, the center of the district, was formerly a cotton town and the main visitors were cotton buyers or drummers doing business with the local stores. During the latter part of 1916 it became a mining town, rivaling a healthy Western boom mining camp. The people of Ashland lived, talked and dreamed graphite. A good many also breathed it, particularly those who worked in the dusty mills and who went home at night carrying a coating on face and clothes.

Ashland's one hotel was simply overrun with mining men and others who wanted to get in "on the ground floor," and one heard of nothing but graphite from early morn until late at night. Additional rooms became a necessity and were built by the obliging proprietor of the hotel, who was making money for the first time in his life, but extra cots were often necessary to accommodate the newcomers, and a private room became an impossibility, not a luxury. In fact, Ashland had a bad case of "graphitis."

Characteristics of Alabama Graphite

In normal times Clay County graphite has been a drug on the market. The reason for this condition was that there has never been any uniformity either in the quantity or quality of the finished flake. The buyers know this from bitter experience and do not buy Alabama graphite if they can get another class.

Good No. 1 flake should run close to 90% in graphitic carbon, while good No. 2 flake should contain about 85%. In buying a hindquarter of lamb one does not want to feel that unless the tail is left as a mark of identification, one may be getting young goat. Likewise, in buying a carload of graphite supposed to assay 90% carbon but containing actually less than 80%, there is likely to be trouble. Some carloads shipped from Ashland have come back again.

Shipments of flake graphite in the past have varied between 70% and 90%, but seldom reach the latter figure. The inevitable result has been a loss of customers, but, just now almost any grade can be sold because of the shortage in the supply. As soon as the abnormal demand subsides graphite will again sell only on merit. The operators are finally realizing this fact and are taking steps to supply a standard product. If the buyers can be satisfied that a standard high-grade and regular supply can be obtained from Alabama, the chances are strongly in favor of their continuing to purchase from there after the war is over, for if properly cleaned there is no better flake to be had.

The methods in vogue for the recovery of the flake from its ore are very interesting, although somewhat crude. There is no separation of mineral from gangue more fascinating than that of graphite, chiefly because there is so little difference in specific gravity between the mineral and the gangue that ordinary concentration methods are not applicable. In fact, the mineral to be saved is lighter by a small fraction than the gangue, but the shape of the flake is the determining factor in the concentrating scheme.

The ore occurs in large veins of granite schist, the flake graphite partly or entirely replacing the mica. It is unfortunate that the mica is not entirely replaced by graphite, because it follows the latter throughout the milling process. Methods devised for extracting graphite work admirably on mica, both being flake and differing but little in weight. However, most of the veins in the vicinity of Ashland are fairly free from mica; and when streaks or bunches do occur in the veins, careful attention on the part of the miner can prevent any quantity of the undesirable material from reaching the mill.

Mining consists simply of quarrying down the ore in large opencuts. There is no underground work in the district. The veins usually occupy the ridges in an undulating region. Working faces can be obtained by cross-

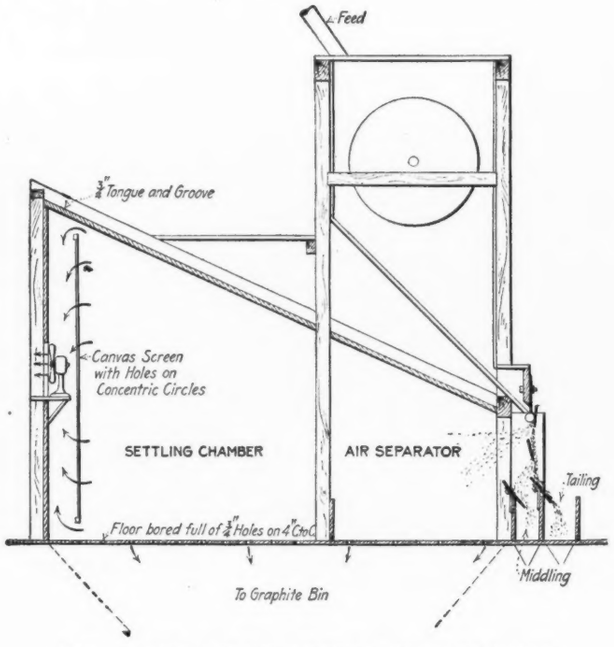


FIG. 1. THE AIR SEPARATOR FOR GRAPHITE

cuts into a ridge until the ore is reached. If a valley or depression cuts across a vein, entrance can be had by merely clearing away the loose top soil for a distance of a few feet.

Holes from 10 to 30 ft. in depth (depending on the condition and height of the working face) are used in orebreaking. These are sprung once or twice with dynamite and, after a chamber of sufficient size has been formed, are shot with black powder. The average cost of broken ore delivered to the mill stockhouse is 25c. a ton. Mine labor is performed almost entirely by negroes, working under a white foreman.

The ore is usually soft on account of the depth of surface decomposition. After reaching the mill, it is put through a crusher of the Blake type and reduced to 2-in. to 3-in. size. From the crusher it may pass on to either a dry pan or muller pan, or to rolls. The dry pans in use are of the type used for grinding clay and are not well adapted to the work required of them. They are

constant sources of trouble and require considerable repairs and renewals. The coarse rolls are much to be preferred.

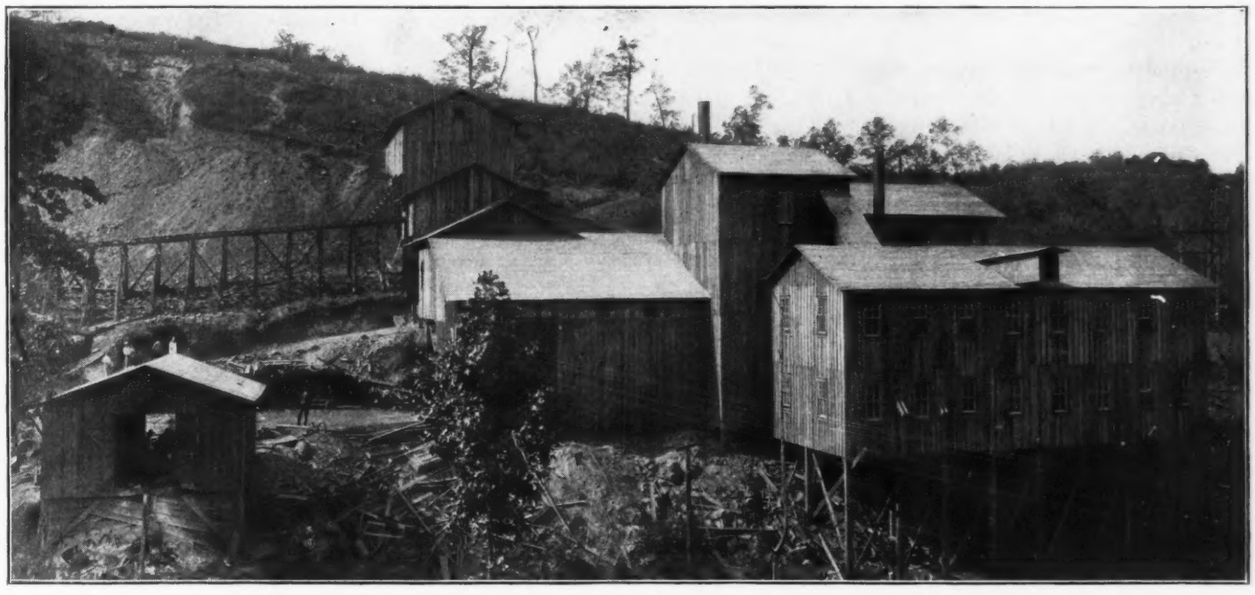
After the ore has been reduced to about half-inch size either by the muller pan or by rolls, it is put through a drier. This is a rotary type and is a simple cylinder 4 ft. in diameter by 40 ft. in length set at a slight angle, ½ in. per ft. Inside and extending the entire length are four *Z* bars, 90 deg. apart. As the drier slowly revolves, the *Z*-bars pick up the ore and drop it, thus assisting its passage through the drier and bringing it into intimate contact with the hot gases from the furnace. One end of the drier extends into the furnace, while the other end discharges the dried ore into a dust chamber, a masonry-walled chamber about 12 ft. square, from one corner of which the stack emerges.

The object of the dust chamber is to arrest the light particles of graphite that have been freed from the ore in the crushing process and would be sucked up the stack unless the velocity of the discharging furnace air was checked. It is a moot question today just how much flake is being lost through the stacks even with the dust chamber in use. Within a radius of several hundred yards of the mills the trees and vegetation are liberally coated with graphite flake.

The next stage in the milling process is a further crushing through rolls set close together. Here the final crushed product is obtained. Usually all but about 15% will pass a 20-mesh sieve, and 50% or more will pass a 40-mesh sieve. This final crushing of the thoroughly dried ore is the cause of the dust that makes a graphite mill the dirtiest kind of a plant in existence. Bucket elevators are freely used throughout the mill and even when closely housed in, help to keep the air full of dust.

The ore now enters the first concentrating stage on washing machines (See Fig. 2) making use of the principle of surface tension. The ore is fed through small spouts from a bin over the washers in such a manner as to form a thin sheet, and falling on an inclined feeding board over which runs a thin stream of water, it is delivered across a sheet of water varying from 6 in. to 9 in. in width and 6 ft. long—the length of an individual washer. The gangue sinks and passes out through four small holes distributed along the bottom of the washer, while the graphite rides across on the surface of the water and discharges over a lip extending along the front edge. A trough running along the front of a line of washers carries the flake and water to a shaking screen or dewaterer. This is a rapidly shaking frame operated by a cam and rocker arm and covered on the bottom with fine brass wire cloth, 90- to 100-mesh. The water and some of the finer flake escape to the nearest creek, while the main portion of the graphite is discharged over the end of the screen to a floor, where it is piled up as crude concentrates ready to be dried again. This product carries about 50% carbon, the washers unfortunately carrying some sand with the graphite.

If the feed to a set of washers assays 3% of carbon, the tail sample will assay 1% or more, so the efficiency of the process is not very high. But in defense of the washer it should be said that part of the graphite in the tailing is due to incomplete crushing. The coarser particles of ore still have flake attached.



CRUCIBLE FLAKE GRAPHITE CO.'S MILL, 150 TONS CAPACITY, AT ASHLAND, ALA.

Up to this point the processes in the roughing mill have been described, although properly speaking, the drying of the crude concentrates from the shaking screens is not a function of the finishing mill, but a sort of intermediate step. In some of the mills this second drying is done by spreading the concentrates in a layer a few inches thick over a large floor built of iron sheets. Steam pipes under the floor supply the heat for drying purposes. Where steam is the motive power in the mill, this forms an economical and satisfactory method, as exhaust steam from the engines is used. Where the drying floor is used, the concentrates from one day's run are spread over it and allowed to remain from 12 to 24 hours. Where the rotary drier is in use, the feed is continuous and the operation similar to that of the ore drier previously described, except that the flames do not pass through the shell of the drier, but along the outside, and the shell is bricked in throughout its entire length. The dried flake is so susceptible to currents of air that, when in

direct contact with the furnace gases, most of it is carried up the stack.

The concentrates are fed by hand at the front end of the drier through a small hole. Another hole, also at the head end, permits the escape of steam formed as the concentrates dry. The dried crude flake discharges into the boot of a bucket elevator and is carried up to the finishing mill.

The finishing mill treats the rough concentrates produced in the roughing mill and is not necessarily a separate building. In fact, in all the plants that have been under my observation, both mills are under one roof. The mills first built were operated by steam, and it was therefore advisable to group the various units in order to avoid an excessive number of engines. When electric power was introduced into the district, the newer mills, which proposed to use electricity instead of steam, still clung to the plan of the older mills purely through lack of knowledge of a better method.

Differences in Mills Under Construction

Some of the mills now under construction are completely separating the finishing mill from the roughing mill. This is an improvement, since it removes the finishing operations from the dust and grime of the roughing mill. The use of electric power makes this simple and practical. One of the recently built plants using electricity is arranged, however, in the same manner as if steam were the motive power. Only two power units were provided, one for the crushing mill and one for the finishing mill. The result is that when it is necessary to operate independently a certain small concentrates elevator and air-separation machine, it cannot be done without running the 75-hp. motor of the finishing mill, although the power required is only about 1 hp. One of the main advantages of electric power, the use of small individual units, was not utilized. In the mills now under construction similar mistakes are not being made.

The first operation in the finishing mill is an incomplete separation of the flakes of graphite from the sand and grit carried across with the graphite on the washing machines. Some of this gangue matter is pulled across by the flake itself, or a particle of sand may ride across on top of a large flake of graphite. A number of flakes often join hands around a grain of sand and sweep it across into the concentrates without giving it a chance to sink.

The concentrates being perfectly dry, the first separation is done in an air machine not of standard pattern. It is built on the ground and of a design according to the whim of the particular operator who is installing it. In the main it consists of a hopper discharging along the length of a roll force feed, on the front side of which is an iron plate held against the front of the revolving feed roller to regulate the amount of the feed. The thin layer of concentrates flowing down from the roll feed crosses an air current produced by a small electric fan, and the flake is swung or sucked into the current, while the coarser sand falls through the air stream into a tailings box or middlings box, or both. (See Fig. 1.)

These machines are of crude design and do not do clean work, but are useful, as they take a considerable amount of the burden away from the buhr mills. The more sand removed before sending the concentrates to the buhrstones, the less will be the grinding necessary and the less will be the inevitable grinding of flake into dust. It should be remembered that No. 1 flake is now worth about 17c. per lb. while the same, ground into dust and polluted with gangue, is scarcely salable.

The principle of the air separator is that a flake of graphite of a certain weight presents more surface to a current of air than a particle of sand of the same weight; or, conversely, flake and sand that will pass a screen of the same mesh will not weigh the same. In the actual operation of the air separator it happens that some of the flakes fall edgewise to the current instead of flatwise and drop through it instead of being sucked along with it.

The general practice is to have a suction current for this operation rather than a blast, because with suction there is less likelihood of counter-currents, eddies and swirls. The finer flake is affected by the slightest draft and is extremely fickle in its movements. It reminds one of light, dry snow and exhibits the same perversity and propensity to swirl, drift and float.

Unless I have been misinformed, there has never been any sizing of the concentrates attempted at this stage

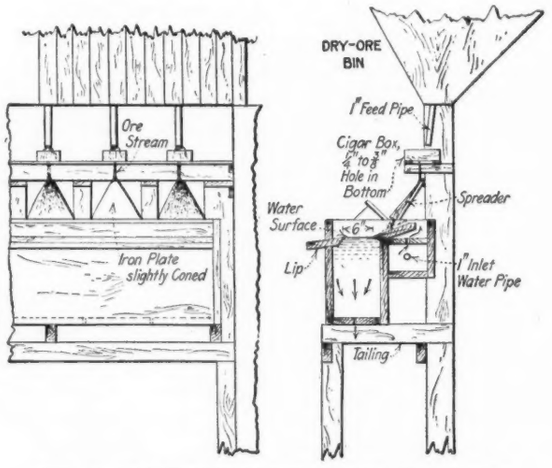


FIG. 2. WASHING MACHINE FOR GRAPHITE

of the process, in this district. The concentrates, coarse, medium and fine, are passed over a current of the same strength, and only one current is used. Any current of air that will deflect or suck in a certain flake of graphite will also deflect a grain of sand—smaller, of course.

Believing that much better work could be done by using currents of different intensity, I recently introduced into the mill of the Crucible Flake Graphite Co. a separator in which a sizing reel first divides the concentrates into two products. The cloth used is Dufour silk grit gauze No. 50—approximately 54-mesh wire cloth. The undersize passes into a hopper bin and thence to a roll force feed and falls through a very gentle air suction created by a 12-in. electric desk fan similar to the one used in an office.

The remainder of the concentrates passes over the end of the reel into another hopper and is fed over a roll force feed across a suction current considerably stronger than the first. The strong current is produced by a 16-in. desk fan, and the cross-sectional area of the current where it is traversed by the concentrates is made smaller than that of the weak current. This reduction in area, together with increased size of the fan, creates a strong draft and a very satisfactory separation is made. Baffles are also used to aid in the separation and play an im-

portant part in the operation. The function of the baffle is to catch grains of sand that are being drawn into the current and deflect them in the opposite direction toward the tailings box. At the same time some of the flakes of graphite that have fallen through the upper part of the current on account of their position (being edge-on to the current) on hitting the baffle have a chance to be turned so as to be drawn in by the lower part of the current.

This machine is doing much better work than the single-fan machine which it replaced, and a much cleaner feed is being introduced into the buhr mills. Still more refinement in this process, such as the use of three currents, is practicable. With the one sizing into two products, however, the final result has been an increase in the proportion of No. 1 to No. 2 flake and also a very decided reduction in the amount of dust produced.

After passing the air machine, the flake is collected in a bin and elevated to a large round or hexagonal sizing reel, which divides the concentrate into three products. The first is dust bolted out through a No. 12 cloth on the upper third of the reel. The second product is the feed for the No. 2 buhr mill and passes through a No. 6 cloth on the middle third of the reel. The third product is the feed for the No. 1 buhr mill and is the undersize through a very coarse grit gauze on the lower third of the reel.

This latter cloth could be discarded where a good air separator precedes the sizing, but in the absence of air separation it is necessary for the purpose of removing trash of various sorts that gets into the concentrate.

Sizing of the Flake

The flake is now sized and in bins ready for the buhr mill. This is simply the old-fashioned flour mill, consisting of two French buhr stones, an upper and a nether, dressed in a little different style and with a graphite dress instead of a wheat dress. The type is being done away with in modern flour mills, and it is hoped and expected that it will also be scrapped in the graphite mills. At present it is a costly necessity—costly because it grind flake into dust, and indispensable because no other method to grind out the last remnants of the grit has, so far, been discovered, but it will eventually be dispensed with. For the present the best solution is to have as clean a feed as possible and reduce the work of the buhr mill to a minimum. With a minimum of grit to be cracked up and ground, a minimum of flake will be destroyed.

The purpose of the sizing reel ahead of the buhr mills is to segregate the coarse flake and grit and permit the No. 1 buhr stones to be set wide, grinding just close enough to allow the grit to be removed from the No. 1 flake, with a minimum of injury to the flake.

The bolting reels (flour dressers) are set in tandem fashion, one above the other, and there is at least one set for each buhr mill.

The discharge from No. 1 buhr mill is elevated to the head end of the top reel and passes into it. The speed of the reels is about 30 r.p.m. This reel is covered with No. 12 silk bolting cloth. The undersize is dust and is spouted down to the bagging room. The oversize—a mixture of No. 1 flake, No. 2 flake and middling—tails over and is covered back to the head of the lower reel. This is covered with No. 6 cloth. This cloth, containing 74 meshes to the inch, usually makes the separation between No. 1 and No. 2 flake. The undersize through this cloth is a middling and is usually conveyed back to the bin which feeds the No. 2 buhr mill.

The oversize is No. 1 flake, ready for the market, and is spouted directly to the bagging room. In one mill where an especially high-grade product is desired, it is re-dusted in a separate reel together with the finished No. 2 flake, and then again sized and the two products, No. 1 and No. 2, are then spouted to the bagging room.

Just why the operations of the bolting reels are conducted as they are has always remained a mystery to me. If I am going to make a sizing test with a nest of wire sieves, I begin with the coarse sieve and work down through the finer sieves. If I had a 5-lb. sample for a screen test, I would not start with the 200-mesh screen and work up to the 20-mesh. That is the precise practice in bolting, however. Suggestions to reverse the order of the cloths and put the heavy burden on the coarse cloth, and separate out the No. 1 flake first, do not meet with approval in this district. It is a custom (*el costumbre del pais*) without rhyme or reason. Some day, however, the reels are all going to be discarded and their place taken by sifters or some kind of vibrating screens.

Finished No. 1 flake is satiny and soft and really beautiful to look at. I like to plunge my hand into the filling sack and feel the softness of it. The miller tests it for grit by letting it slowly filter between his fingers, or by rubbing it between the end of his forefinger and thumb. The old millers become quite expert and can tell you whether the flake will pass 90% in carbon or fall below, just by the feel. But if a sample is assayed, the returns do not always check with the miller's verbal assay.

Another way to test the flake is to sprinkle it in a thin layer on a piece of plate glass; then press it firmly with a steel table knife, beginning at the end of the blade and coming back toward the handle. If grit is present each piece crackles like a pistol shot as the knife blade crushes it against the glass.

Clay County Deposits

Clay County is just becoming acquainted with the possibilities of its vast deposits of graphite. Probably more earnest study has been given to the question during the last six months than in the entire previous history of the industry. The next twelve months will see many improvements. Among these will probably be the introduction of a wet method of crushing and the abandonment of the crude washers now in use, which render necessary the drying of the entire tonnage of ore.

It is also quite probable that some form of air separation will almost or quite displace the use of the buhr stone. A closer sizing of the concentrates before subjecting them to air currents, and a further differentiation in the strength of currents used to separate the flake from the sand will in my opinion, yield products that can be sieved direct, without the use of buhr mills.

There is some doubt whether strictly first-grade flake can be produced without a slight grinding of some sort in the final stage of cleaning. The examination, under a glass, of flake that has not been through a buhr mill shows a thin film of brown rust on many of the flakes. The flake in bulk has not the satiny gleam of the ground flake. This film could probably be removed by some type of fine differential rolls without causing the excessive destruction now going on in the buhr mills.

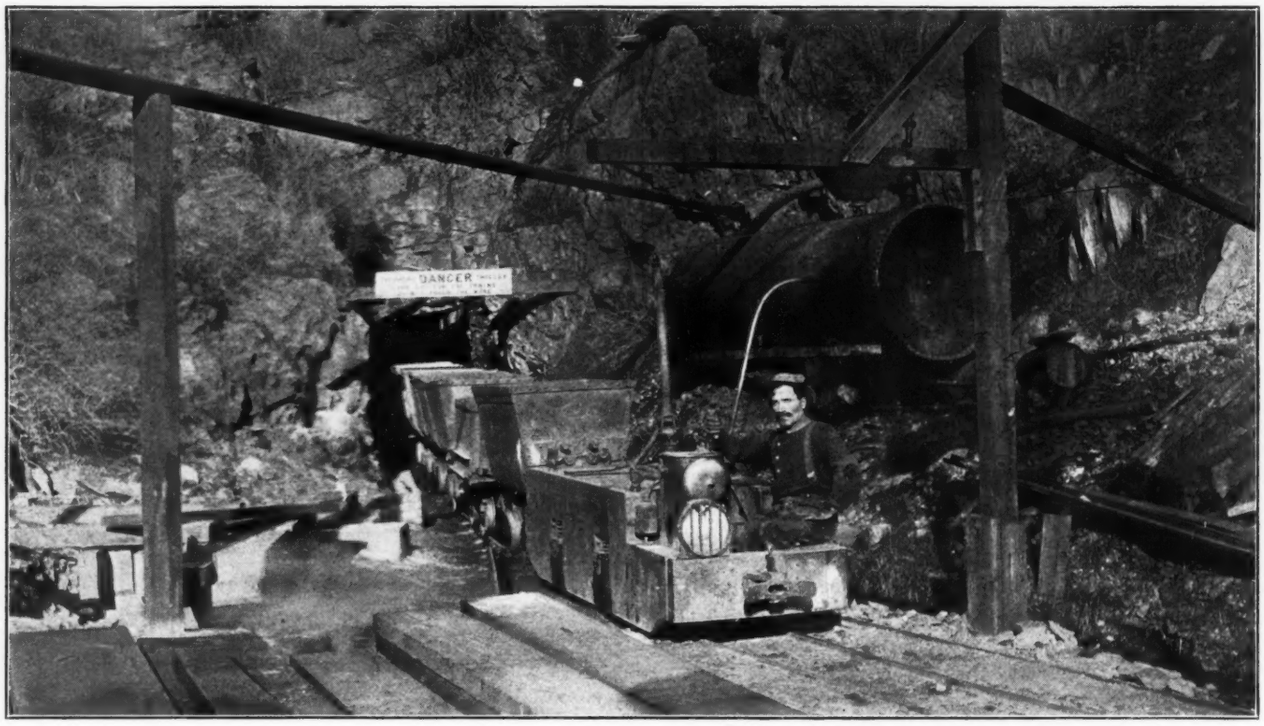
A Narrow-Gage Alternating Current Mine Locomotive

By Rudolph W. Van Norden*

SYNOPSIS—The haulage tunnel at the Mountain King mine, California, was equipped with an 18-in. gage track. An alternating-current locomotive, operated by two standard-type 5-hp. General Electric motors was designed and built of standard parts in San Francisco. For 18 months' operation this motor has given satisfactory service. Several unique features are embodied in its design.

Electric traction has long been recognized as a satisfactory solution of the mine-haulage problem where tonnage to be transported is beyond the capacity of mule power and where space restrictions and the undesirability of vitiating the air in underground passages, by the exhaust of engines, precludes the use of gasoline, steam or compressed air. Electric locomotives receiving their energy either from a storage battery or from a trolley have been in general use for many years, and there is nothing novel in mines so equipped, where there are long hauls over tracks whose alignment is characterized by extreme curvature, where narrow tunnels require minimum gages and where headroom is small. In such mines, throughout the world, direct-current electricity has been almost universally used. This is because of the superior control and the satisfactory speed-variation characteristics of the series-wound direct-current motor. Until recently the use of alternating current for railroad operation has been rare. There are a number of alternating-current systems that have been successful, but these have employed induction motors, which necessarily were operated by three-phase current. This requires the use of three feeder conductors. With a railroad, where the track may serve as one conductor, two feeder wires are required. This feature has rendered the equipment of railways for alternating current, particularly in mines, impracticable. Another disadvantage is the unsatisfactory speed-regulation characteristic of the induction motor. Speed regulation is accomplished at the expense of efficiency.

The effort to employ alternating current for railway work, with its many advantages from the generating and distributing standpoint, has resulted in the development of the single-phase repulsion motor. This type of motor has some of the speed-torque characteristics of the direct-current railway motor and may be controlled in much the same way, but is not equal in efficiency and cannot be compared, for general railway work, with the direct-current machine.



THE MOUNTAIN KING 18-IN. GAGE LOCOMOTIVE COMING OUT OF THE MOUTH OF THE MINE TUNNEL

Where electric haulage is proposed for a mine and the power requirement is small, the greater simplicity, less equipment, freedom from intermediate converter losses, lower cost of operation and lower first cost of installation more than offset the slightly greater amount of power required by an alternating-current single-phase system in place of the ordinary 250-volt direct-current or storage-battery equipment.

*Consulting engineer, 510 Rialto Building, San Francisco, Calif.

Most mines are now equipped for operation by electric power purchased from a distributing company or generated in a plant operated by steam or water and owned by the mining company. In either case the majority of such installations supply three-phase alternating current and the machinery, including hoists, is driven by induction motors. In order to produce the energy required for the haulage by direct current, it is necessary to install a motor-generator with its regulating and control apparatus. This may, if the system be extensive, require an attendant, or in any case part of the time of a man that might be used to better advantage. With a storage-battery system the added equipment is still more complicated, because there must be, as in the other case, a motor-generator or, in a small installation, a rectifier for charging batteries; there must be a station for charging and changing batteries, where one set for each locomotive must be undergoing charge, which requires skill and attention, and where once or twice each day the batteries in the locomotive must be removed and the newly charged set inserted. The cost of this system is high, by reason of the greater first cost of the locomotive with its battery and the need for a spare battery unless it is intended to use the machine only a part of each day. On top of the first cost is the high deterioration of the batteries, requiring the expense of constant renewals. This may be exaggerated by unskillful care and attention.

There are many mines where the output can be moved by mule power, but where a slight increase in tonnage necessitates complications in added switches or double tracks, or a lower operating efficiency owing to the crowding of the passages. These points in economical operation do not always appear until more rapid haulage in larger trains and covering shorter periods is adopted. For this reason many mine operators have not seen the desirability for electric haulage in view of the first cost of installation.

Haulage Problem of the Mountain King

Such a situation was presented to me in 1914, when I was called to solve the power and milling problem at the Mountain King mine on the Merced River in Mariposa County, California, by the installation of a modern hydro-electric power plant and milling plant. The two problems proved to be entirely separate, the latter being a requirement for mechanical efficiency and motion study efficiency, with the assumption of adequate power supply. But any further successful operation of the mine required immediate procedure within the lowest possible cost, as the money for construction had to be obtained from stockholders by assessment.

The Mountain King mine is entered by an adit whose level, at the time this work was commenced, was the lowest in the mine development. This adit starts from a gulch tributary to the Merced River, about 300 ft. above and 1200 ft. distant from the river. All the older workings in the mine extend upward to the surface for 1000 ft. The distance from the adit to the farthest drift was, at the time, about 3000 ft. This part of the mine was also the principal source of ore, the drift passing through the three largest oreshoots.

There was an 18-in. track of 12-lb. rail in this adit, passing from the mine thence along the hillside and terminating at a bin from which the ore was carried on an inclined two-car gravity tramway to the mills, situated on the edge of the Merced River. The grade of the track into the mine was nowhere greater than 1%; a mule supplied the motive power and was able to haul three or four one-ton empty cars against this grade into the mine. With the aid of the slight grade the mule had no difficulty in pulling the loaded cars out. With one mule working somewhat over one shaft, it was possible to haul 40 tons of ore per day. As this was more than the capacity of the old mill, the mule haulage was quite satisfactory.

As soon as the new mill, situated on the hillside, with its capacity of over 100 tons per day, was built, the haulage problem became important. The drifts in the mine are no larger than absolutely necessary. The main crosscut does not require timbering, the section being 5 ft. wide and from 6 to 8 ft. high. This crosscut is a tangent and presented no difficulties to any sort of electric haulage system. The vein that is followed is intersected by the crosscut about 800 ft. from the entrance. The drift is sometimes in the foot wall and sometimes in the hanging; much of it is timbered and where it is in self-supporting rock, it is often narrow or has sloping walls, and the alignment for a track is necessarily poor. There are a number of curves of short radius. Without great expense for enlargement, there is not sufficient room to accommodate standard locomotives. To maintain the 18-in. gage was necessary, and it was impossible to lengthen curves except at great expense; and yet, to operate a locomotive necessitated a machine not over 33 in. wide and with a wheelbase of not more than 36 in. Coupled with these limitations was the necessity for sufficient power to haul 10 to 20 empty cars and as many loaded cars, besides providing for rapid switching and haulage. Furthermore, owing to the single adit and the comparatively small drifts, the operation of trains in all shifts, while men were passing in and out of the mine, was neither safe nor economical, and the desirability for the movement of a large tonnage in comparatively short periods was evident.

Power Conditions at the Mountain King

Electric power for operating the mine is generated in the company's own hydro-electric plant on the Merced River, 1½ miles below the mine. This is transmitted at 4000 volts, three-phase, to three 100-kv.-a. lowering transformers at the new mill. These transformers supply current at 440 volts to all the motors in the mill, compressor-motor, hoist on the supply tram between the loading platform of the Yosemite Valley R.R. and the mine railroad, 300 ft. above, also a powerful shaft hoist within the mine operating to the 1300-ft. (new development) level. The transformers are delta-connected on both sides, and on the low-tension side the middle point of each transformer is tapped and brought out to a terminal. The middle point of transformer *B* is thoroughly grounded and tied solidly into the air-pipe system of the mine. All lighting throughout the mine and camp is supplied from three wires in three-phase relation at 220 volts across any two legs. This is obtained by tapping to the delta connection between transformers *B* and *C* the middle connection of transformer *C* and the middle point (grounded) of transformer *B* (Fig. 4). Current for the railroad is taken directly from the transformers, the grounded center point of transformer *B* being tied into

the rails. The trolley lead is taken from the delta connection between transformers *B* and *C*. By this method the trolley and lighting loads do not overlap in the transformer, for while a part of the lighting load is being carried by one-half of transformer *B*, the other half is independently carrying the trolley load. At the same time the lighting circuit is grounded in one leg, which is desirable and would be impossible with any other connection.

The use of alternating current directly from the transformers, without the necessity of any converting apparatus, with its attendance and upkeep, or the cost, maintainance and bother of storage batteries, appealed to me, while the disadvantage of slightly lower efficiency in the use of single-phase repulsion motors was a matter of small moment and could be overlooked in view of the fact that converter losses amounting to 30% of the power within the restrictions of the requirements in this special instance. Plans for the design of such a locomotive were discussed with J. W. White, engineer for the Industrial Equipment Co., of San Francisco, who was then planning a single-phase light locomotive for industrial works.

Specifications were prepared and tentative designs made for a 3-ton locomotive with a standing drawbar pull of at least 750 lb. and a speed of 6 miles per hour. As soon as the design was finally decided upon, plans were made standardizing parts to adopt them to the shop practice of this firm, and the order was placed. The locomotive has, during 18 months' operation, given a most satisfactory service, exceeding the duty requirement by 50% and handling the output of the mine with ease.

The locomotive has an over-all length of 9 ft. 2 in., the clear width is 33 in., and the height of the deck above the rail is 32 in. Standard M. C. B. cast-iron

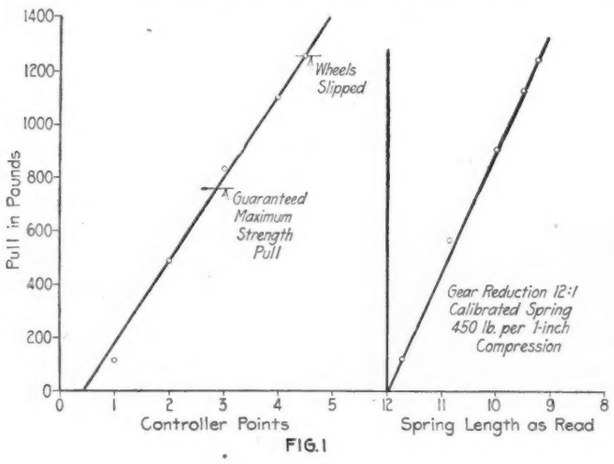


FIG. 1

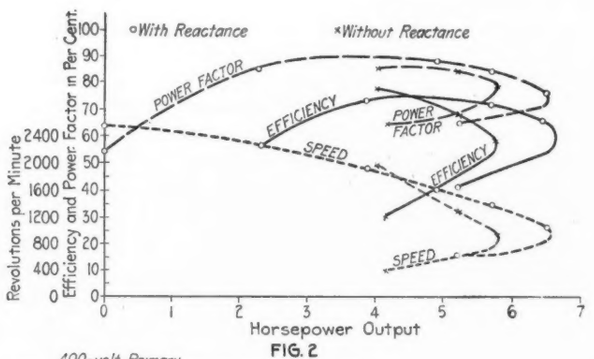


FIG. 2

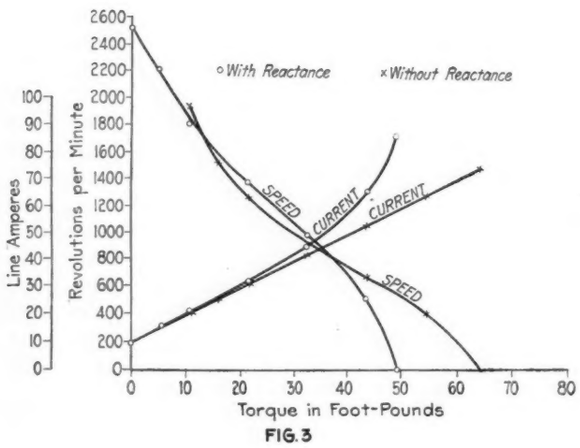


FIG. 3

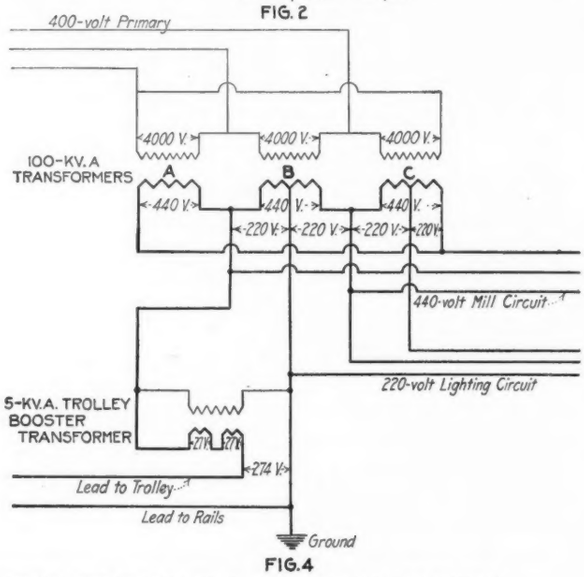


FIG. 4

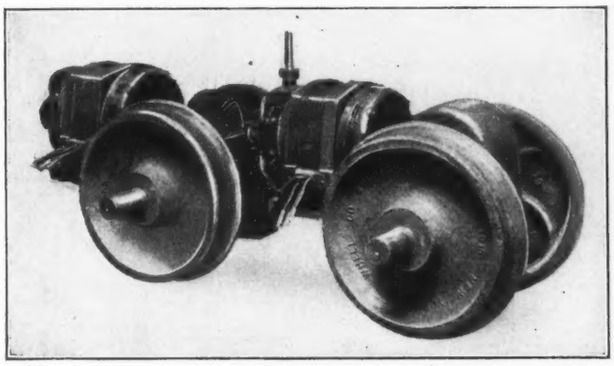
FIGS. 1 TO 4. CHARACTERISTIC CURVES OF THE LOCOMOTIVE PERFORMANCE AND WIRING DIAGRAM OF THE TRANSFORMERS

supplied in direct-current systems is absent and also that the company operates its own power plant and obtains therefrom ample power for all purposes.

At the time there had just been placed on the market a mine locomotive equipped with one single-phase repulsion motor, but this machine was not suited for our service, because it was too large and heavy. There being no other suitable locomotive on the market, I set out to design one that could be built locally and that would fall wheels with chilled treads are pressed on $2\frac{3}{4}$-in. steel axles. The bearing boxes, which are held in the side frames in guides, are of standard cast steel, with bronze bearing seats in the upper half. Chrome-nickel-manganese steel spiral springs are used. The chassis consists of four pieces—the two side frames, which are of box section heavily ribbed on the inside and into which are cast two sand boxes, and two end-frames of heavy channel section into each of which is bolted an oak buffer covered

by a piece of boiler plate. Standard draw-eye couplings are bolted to the end frames. The side frames at one end are built low for a distance of 30 in., to the level of the top of one of the end frames, and within the space so formed is placed a sheet-steel floor. This space provides room for the controller box, brake wheel and a seat and leg space for the operator. The deck of the locomotive is flat and is made of two sheets of steel, ¼ in. thick; these are provided with dowel pins that fit into holes in the side frames, and the plates may be lifted off in order to inspect the interior of the machine. This top offers ample space for drill bits or machinery parts to be taken in or out of the mine.

Up to this point in the design, except for its extreme narrowness and small height, the locomotive does not differ notably from conventional practice. The power equipment consists of two 5-hp. General Electric single-phase repulsion-type motors. These are wound to operate at 1200 r.p.m., 220 volts, 60 cycles. The mounting of these motors and the form of drive is interesting. With a track gage of 18 in. and such a short wheelbase, it would be impossible to mount motors in the conventional manner of railway work; that is, with the axis of the motor



FRAME AND TRUCKS OF LOCOMOTIVE, SHOWING ARRANGEMENT OF THE TWO 5-HP. MOTORS

parallel with the wheel axle and engaging therewith through spur gears. These motors are mounted with their axes parallel to the longitudinal axis of the chassis, each being placed on the side of its respective axle away from the controller end of the chassis. The motors are standard, taken from stock, no special dimensions being required, the standard shaft extension for the pulley being a sufficient mounting for a bevel-gear pinion, the first unit in the drive.

The drive between motor and axle is inclosed within a gear box that forms the motor support and maintains the alignment. This gear box is of cast iron and surrounds the axle and occupies the entire space between the wheels. At either side where the axle passes through it are bronze-bushed split bearings, the box being split horizontally. Keyed to the axle and within the box to one side is a solid disk split steel spur gear, 10 in. diameter, containing 60 teeth. Above the axle, its axis being in the same vertical plane, is a 2⅛-in. jackshaft that is carried in bronze-bushed bearings mounted in the sides of the gear box, the box being again horizontally split to accomplish this. The jackshaft carries a 3-in. spur-gear pinion with 18 teeth that engages and drives the spur gear on the axle; also a 9-in. bevel gear, carrying 54 teeth, the latter being of the type used in the drive of an automobile. The lower casting of the gear box is extended horizontally to form a platform which carries the motor which is bolted to it. An opening in one side of the gear box in which is placed a felt washer to prevent the ingress of dust, allows the shaft of the motor to protrude into the gear box and its 2½-in. 15-toothed bevel pinion to engage the bevel gear on the jackshaft. As this gear box and motor mounting is supported by the axle on one side, the entire rig is free to revolve around the axle. In order to support the box and motor in its proper position and to resist the turning thrust against the axle, there is provided a spring support to an angle cross-member bolted to the top of the side frames. This support, which consists of a long bolt, is fitted with rubber cushions on both sides of its seat, to check vibration and the torque thrust of the motor in either direction. The bolt supports the motor at the upper side of the outer end-bell which is a part of the motor housing. By this method of support, no distortion, due to uneven track or any other defect, can cause the motor and running gear to get out of alignment, while the motor has a flexible support at all times. The reduction between the motor shaft and wheels is 12 to 1. As the motor makes 1200 r.p.m., at full load and normal speed the wheels revolve at 100 r.p.m. which is equivalent to a speed of 6 miles per hour. The gear box is partly filled with hard oil or grease, so that the gears are at all times running in a lubricant.

Method of Motor Control

Motor control is obtained by a standard double-drum controller with grid resistances, there being five running points, both forward and reverse. The controller is mounted at one side, in the operator's pit. Immediately back of the partition between the car body and the pit is placed the grid resistances for both motors. The wiring between the controller, resistances and motors is inclosed in flexible steel conduit, as are also the headlight circuits. A General Electric standard mine headlight is mounted on the operator's end of the chassis. The trolley is General Electric, mine-style, type D4. The pole is of wood, about 8 ft. long, and carries a 4-in. bronze trolley wheel with a swivel mounting, offset to give a caster effect, so that the trolley wheel will always draw straight, whether the pole is pulling in line with the trolley wire or not. The trolley is mounted on the chassis at one side in a swivel socket, and this has a holding-down lock that holds the pole flat to the deck of the locomotive when the trolley is not in use.

There are brakes on all four wheels, with removable shoes. These brakes are connected through a system of compound levers and are operated simultaneously by a hand-wheel whose shaft is threaded and on which runs a floating nut engaging the lever system.

Tests of the motors were made before they left the manufacturers, and after the locomotive was completed a series of tests were conducted which gave results in excess of expectations. With the rated capacity of the motors of 10 hp., a drawbar pull of 750 lb. was expected and deemed to be sufficient for the service requirement. This figure was exceeded by 80%, or to the point where the adhesion to the rails, a function of the weight, was overcome and the wheels spun. This point occurred within the probable maximum duty of the motors, as shown on the accompanying curve (Fig. 1). In making this test a track of

12-lb. rails was used and the pull was against a calibrated spiral spring in compression. There was some variation in the voltage, due to line drop, and this was rectified in the determination of results based on 220 volts impressed, for which the motors were built. The accompanying table gives the net results of this test:

TABLE SHOWING DRAWBAR PULL IN CALIBRATION TESTS

Controller Point	Line Voltage	Current, Amperes	Deflection of Spring, In.	Drawbar Pull Actual, Lb.	Drawbar Pull Corrected for 220 V., Lb.
1	273	48	11⅜	112	110
2	255	67	10¾	560	482
3	235	80	10	890	830
4	221	100	9½	1100	1100
5	205	122	9¼	1210	1390

Figs. 2 and 3 show characteristics of the motors.

Preparation of the Route

In preparing the adit and drifts for this equipment, it was deemed advisable, where the 12-lb. rails showed wear or were in bad alignment, to remove them for use in more remote parts of the mine and substitute new 16-lb. rails. The crosscut to the intersection of the main drift was entirely so reconstructed, and new 4 x 6-in. ties, spaced not to exceed 24 in. centers, were laid throughout. For purposes of safety as well as convenience, the trolley wire was suspended to one side, approximately 9 in. outside of the righ-hand rail, entering the mine. This trolley wire, which is of round hard-drawn copper, was, for the sake of economy, in the face of the rising price of copper, of the smallest cross-section that would give proper voltage at the most distant points in the mine, where the need for maximum power is greatest. The size used was No. 2, which extends a distance of 2000 ft., while beyond this point and into the various drifts and crosscuts the size is No. 4. Both of these sizes are smaller than generally used, but with this type of equipment, and by a slight boosting of the voltage at the transformers, successful operation is feasible.

The trolley is suspended from mine hangers furnished by the Ohio Brass Co. In the rock sections 1¼-in. holes were drilled from 4 in. to 6 in. deep in the roof, in which were inserted expansion bolts to which the hangers were bolted. In the timbered sections, hangers were lag-screwed to the timber caps. A simple pole and arm construction was built outside, carrying the trolley 9 ft. above the rail. In the mine the height of the trolley varies from 6 to 8 ft.

The matter of protection from contact with the trolley, either direct or by swinging a bar or pick into it, on the part of a miner walking along the track was the subject of much thought. A 10-in. board 1¼ in. thick was suspended on a bracket, which in turn was suspended, in the rock sections, either from the hanger support or from an anchor bolt of its own, in such a manner that the wire is at all times behind the board; that is, the board is between the wire and a person walking along the track. This was found to afford ample protection unless anybody actually reached up behind the board and touched the wire. A number of such cases occurred, when a miner stepping aside actually raised his head, or the candle fastened on his cap, against the wire. To remedy this condition, a second board on the other side of the wire has been added, both boards being tilted so that their bottom edges approach each other, leaving a narrow slot, sufficient only for the trolley wheel to pass between. This method appears to give ample protection against accident.

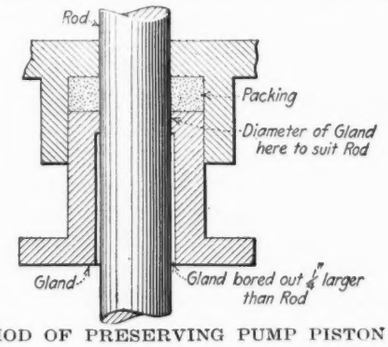
To provide a low-resistance return circuit, the rails are bonded, and cross-bonded at intervals of every 300 ft. At several points these bonds are carried to the air-supply pipe, which rests on the ground to one side. The bonds were made at the mine. They are No. 4 copper wire and are 24 in. long so as to clear the fishplates. Holes were punched in the webs of the rails, and tapered brass plugs were driven into these holes, the protruding ends being rivited over, thus making a good low-resistance contact. In making the bond a hole the size of the wire was drilled in the extended end of each plug, and the end of the bond wire was inserted and the whole dipped in a bath of solder. This construction made a cheap, efficient and quickly assembled bond. The cost was 6c. per plug, or 12c. per bond; wire, 8.5c.; cutting wire and soldering lugs, 3c.; a total of 23½c. per bond. This is considerably less than the cost of any standard low-resistance contact bond.

In order to give the full 220 volts at the terminals in the mine, a small booster-transformer of 5 kv.-a. capacity was installed (Fig. 4). This is a standard Mazda sign-lamp transformer with 220-volt primary, and 27-54-volt secondary. By a series, or parallel connection in the secondary terminals of this transformer, the line voltage of 220 may be boosted to either 274 or to 247 volts respectively.

While the motors are required to receive a slight over-voltage when the locomotive is at the mill end of the line, this is not disadvantageous, because the repulsion motor permits of considerable voltage variation and rise.

Preserving Pump Piston Rods

An engineering correspondent of the *Shipbuilding and Shipping Record* recommends the method shown in the accompanying diagram, and adopted by him, for preserving feed and other force-pump piston rods and mitigating errors when adjusting glands of working pumps. The article is reprinted in *Iron and Coal Trades Review*, Mar. 2, 1917, giving the advantages of the appliance. Boring out the gland was adopted with separate pumps supplying feed water to boilers of 6000 hp. and a



METHOD OF PRESERVING PUMP PISTON RODS

working pressure of 245 lb. per sq.in. The gland flanges were not weakened in any way. By adopting this method it is said to be practically impossible for the rods to heat up, owing to the greatly reduced depth of gland through which they have to work, and thus the scoring and roughening of the rods is avoided. Should the gland require to be hurriedly screwed up when the pump is working, and the glands be unequally adjusted, danger to the rods is to a great extent obviated.

Mining Engineers in Belgian Relief

Copyright, Underwood & Underwood

HERBERT C. HOOVER

Chairman of the Commission for Relief in Belgium

Copyright, Underwood & Underwood

W. L. HONNOLD

Director in America of the Commission for Relief in Belgium

Copyright, Underwood & Underwood

EDGAR RICKARD

Assistant Director in America of the Commission for Relief in Belgium

Photo by Gessfore

J. V. N. DORR

Chairman of the Belgian Kiddies Committee

War Importance of Canada's Mineral Resources*

By Arthur A. Cole†

SYNOPSIS—Attention to the importance of the mineral industry of Canada is pointed out by drawing attention to the attraction of French mineral deposits to the Germans and their effect on the strategy of the European War. The extent and organization of the Canadian industry is reviewed.

Mining engineers in the practice of their profession are usually called away from the larger centers of civilization to labor in the development of the newer parts of the country. Their work carries them into action, and they are prone to forget that the importance of the mining industry, which is self-evident to them, may not be so apparent to the outsider. The war is emphasizing every day the great importance of the mining industry, but even yet too little attention is paid to this subject. When the war broke out, the industry was woefully unprepared to meet the calls upon it, and while much has been done since then, more still remains to be done. In this reorganization a well-informed and sympathetic public is of material assistance.

The latter part of February Premier Lloyd George pointed out in a speech upon what he considered the ultimate success of the Allied cause depended. A large space was devoted to mining. He called for more men to work the industries at home, but particularly for experienced woodsman to cut mine props for the coal mines. The next two paragraphs referred entirely to means of increasing the production of iron ore. Surely it is significant that the coal and iron situations are discussed at length and disposed of before the food situation is even mentioned.

The Mining Industry in Belgium and France

Before coming to the mining industry in Canada, let us consider the western battle front in Europe and see how that line is influenced by the minerals in its vicinity. Germany for years past has paid particular attention to her mining and metallurgical industries, and this has proved a great source of strength. Examining a map of Belgium, one will find that the general line of advance of the Germany army through Belgium was along the valley of the Meuse. This is the line of the principal coal deposits of the country, which are at Liege, Huy, Mons and Charleroi and the newly discovered deposits to the north of Liege known as the Campine field. The coal output of Belgium the year before the war was 22,500,000 tons. The principal French field, and the one now in the possession of the Germans, is the field of Valenciennes, which is the continuation of the main Belgian field, the whole being known as the Hainault Basin. The coal output of France for the year 1913 was 40,000,000 tons, the bulk of which was probably supplied by the Valenciennes field.

Before 1870 French territory extended east to the Rhine. At the close of the Franco-Prussian War Bismarck laid it down as axiomatic that the valley of the Rhine must be secured to Germany by the possession of both banks, and in order to do this the provinces of Alsace and Lorraine were taken from the French. In Alsace the natural boundary between the two countries was the Vosges Mountains, but when it came to Lorraine there was no such natural boundary. There were, however, valuable iron-ore areas, so the boundary was arranged to throw all of the then known iron deposits into German territory. As soon as France began to recover from the results of the war, her engineers started boring on the French side of the line. A simple explanation of the structural geology of this area is that the different formations are slightly tilted from the horizontal and dip gently toward the valley of Paris. Thus in traveling from Lorraine toward Paris the different geological formations are crossed at right angles in gradually ascending scale. The iron-bearing formation outcrops in the German acquired province of Lorraine, but the deposits continue in gradually increasing depth coming west in French territory. The French engineers soon located the continuation of these iron deposits by means of bore holes and at once began development, and in the face of considerable difficulties by the year 1914 they had developed a larger iron industry than that on the German side of the line and had greater ore reserves.

The French deposits occur in what is known as the Briey Valley, and these form one of the most important iron-ore areas in Europe. The production in 1913 was about 30,000,000 tons. This area has been in the possession of the Germans since the beginning of the war, and it has been estimated that last year it supplied 60% of the total German iron-ore production.

The possession by the Germans of this iron field along with that of the Valenciennes coal field deprived the French at one sweep of the greater part of their iron and coal resources. This, of course, was a great blow to them and a corresponding source of strength to the Germans. The Briey Valley containing the French iron-ore deposits lies between Verdun and Metz. The most plausible reason for the German attack at Verdun was that they knew that if a breach could be made in the French lines at Verdun, which was one of the strongest points in the line, it would mean that the French would have to consolidate their lines at a considerable distance back from Verdun, and this would remove the iron deposits from the immediate danger zone.

Germany's economic dependence on the Briey iron field for essential raw materials is shown by the following communication, which on May 20, 1915, was sent to Chancellor Von Bethmann-Hollweg by Germany's six great industrial and agricultural associations which ran as follows:

> **The manufacture of shells demands iron in a quantity so great that no one could have formed an idea that so much could be used had not our need of it been demonstrated. If we had not been able to double the production of rough iron and steel since the month of August, 1914, it would have been impossible to continue the war.**
>
> **We might count the war as very nearly lost should our production of Minette (the Lorraine material) be disturbed.**

*Address delivered before the Canadian Club of Montreal, Mar. 5, 1917.

†President, Canadian Mining Institute, mining engineer, Temiskaming & Northern Ontario Ry., Cobalt, Ont.

This quotation shows how important French iron is to the Germans. The Belgian coal mines and the iron mines of Briey are the two elements that the Germans most require for their war.

Now consider Canada. It is sometimes salutary to look at a country through the eyes of an outsider. A year ago an article appeared in the *National Geographic Magazine* from the pen of Ex-President Taft on "Great Britain and Her Daughters." Mr. Taft was amazed that Canada should be ready to add to her national debt at rate of $1,000,000 a day in support of her military policy in view of her existing heavy obligations incurred in the construction of railways by pledging her credit to aid them. He says: "In the Intercolonial, in the Canadian Pacific, in the Grand Trunk Pacific and in the Canadian Northern, obligations have been assumed that might well frighten a country with 8,000,000 of people." Canada's great railway construction is what impressed Mr. Taft.

Mining Furnishes Most of the Railroads' Traffic

Most Canadians, if asked why so much railway development, has been done, will answer that it was primarily with the object of opening up vast agricultural areas, and likely they would be right. Now I do not wish for a moment to minimize the importance of the agricultural industry. It is the most important basic industry, but we should try to see things in their true perspective. Now that the railways have been built, who supplies the business to them?

Take for example, the Temiskaming & Northern Ontario Ry., Ontario's government railway. The T. & N. O. Ry. was projected as a colonization railroad to open up the large agricultural areas to the north of Lake Temiskaming known as the "Clay Belt" of Northern Ontario. Who provides the freight for this railway?

During the last five years the mining industry has been accountable for 47% of the total freight revenue, while agriculture gave nearly 13%, or a little over one-quarter that of the mining industry. Thus the railway was built for the farmer, but the miner supplies the freight. If the railway was forced to depend on the farmer for its freight revenue, it is likely that travelers would have to be content with one or two mixed trains each way weekly instead of, as at present, from two to three up-to-date passenger trains daily.

Lest this may appear to be an exceptional case, consider Canada as a whole. In the report for the fiscal year 1913 the Department of Railways and Canals published figures from which the following are pertinent: For the year 1913 the products of agriculture handled by the Canadian railways formed 16% of the total, and during the same period the products of mines was 38% of the total, or more than twice as much; and these percentages were practically the same for the six years previous. The manufacturer need not think that he makes a better showing than that, for manufactures come 1% less than agriculture (14.8).

The figures prepared by the Interstate Commerce Commission covering freight traffic over the railways of the United States show that for two years which were considered normal, the products of agriculture were 9% of the aggregate, while the products of mines formed 53% of the total, or nearly six times as much. These are facts that cannot be got away from and which show that, from a railway standpoint at least, the mineral industry is of immense importance.

The total mineral production of Canada now amounts to $175,00,000 annually. In a list of the mineral resources it will be found that few of the important ones are missing, and in some of those Canada leads the world. The coal resources are among the greatest in the world. The asbestos deposits in the eastern townships of Quebec supply most of the asbestos of commerce. The greatest nickel deposits in the world are located at Sudbury. Ontario has the largest body of high-grade talc on the continent at Madoc; the largest body of high-grade feldspar on the continent in the Richardson mine near Vercona; the greatest mica mine on the continent at Sydenham, and the greatest graphite mine at Calabogie. Quite recently also a molybdenite property has been discovered within 25 miles of Ottawa that bids fair to outstrip all rivals. The tar-sand deposits of northern Alberta are the most extensive in the world. One of the richest silver camps in the world is at Cobalt, and the most promising of the younger gold camps on the continent is at Porcupine. The smelteries at Deloro and Thorold also produce more refined cobalt than all the other refineries in the world put together.

With such a magnificent heritage Canada would be delinquent in its duty if it did not give the mineral industry the careful attention that it deserves.

The Organization of the Industry

In the past there has been too little coöperation between the miner and the manufacturer. The lack of organization was unnoticed until the war broke out and then the deficiencies were made apparent. In March last, at the request of Sir George E. Foster, Minister of Trade and Commerce, a special committee of the Canadian Mining Institute was appointed to study conditions in respect of the mineral and metal industries of the Dominion with a view to determining: (1) To what extent Canada can supply the requirements of the empire, and thus help to make it self-supporting and independent of outside sources for those supplies of materials essential to its needs both in times of peace and war; (2) to indicate the possibilities as regards the utilization of the natural resources of the Dominion to greater national advantage than heretofore in the upbuilding of home manufacturing industries.

In other words, there is apparently sound reason to believe that a great quantity of raw material is being exported, which could be much more profitable, so far as the national interests are concerned, if made the basis of manufacturing industries at home; and also importing supplies, a considerable proportion of which could quite readily and most advantageously be produced at home. In some cases it will be necessary merely to indicate the opportunities that exist for the establishment of new industries to effect the desired end; but in other instances government encouragement will be required.

One does not need to be a stockholder in a mine to be financially interested in its developments. Take for instance, the little camp of Cobalt. Of course, a camp to be successful must make profits, and Cobalt does that, and the result is the dividends that are paid. That is what the shareholders are most interested in. But look at Cobalt from the angle of a nonshareholder. It costs $7,000,000 annually to run the Cobalt mines, most of which eventually finds its way down to Toronto and Montreal to be spent there.

It is doubtless lack of information that makes the public so often judge the mining industry from the losses made through gambling in mining stocks. When a man gambles in wheat and loses, he does not blame the agricultural industry. He usually keeps quiet about his losses, but privately he must confess to himself that they are due to his own ignorance or inability to properly size up the wheat situation. He should treat the mining industry in the same way.

If a man is heard blaming the mining industry for his losses, he is simply proclaiming to the world that he is a gambler in mining stocks, and on inquiry it will usually be found that although he may be a shrewd, careful and successful business man in his own line, when it comes to mining he throws shrewdness and common sense to the winds and ignores usual business methods. Under the circumstances the dice are loaded against him and he has not an ordinary gambler's chance.

If a man were offered a bargain in real estate, he would not think of paying over his money before he had made a personal investigation of the property or had got an expert opinion on it, or both; yet, when buying a mining property, that same man often puts up his hard-earned savings without anything more than a seller's report. If one wishes to invest in the mining industry, and not simply to gamble in mining, and uses ordinary business principles and common sense, I know of no other industry that gives larger returns for the capital invested.

Forecasts for the future may be considered superfluous, but I think that in this case they may help in a campaign for better preparedness for the future. Again let us turn to our northland for inspiration. Anyone who looked over the unbroken forest of northern Ontario a dozen years ago and predicted that this district would soon be producing $20,000,000 in gold and silver annually, paying dividends almost equal to those of all the chartered banks of Canada put together, would have been put down as a fantastic dreamer, but that is a fact today and the output is continually increasing. And yet only a small portion of the country has been prospected. Running northeast and northwest from Cobalt and extending to the Arctic Ocean, taking in all northern Quebec and northern Ontario is the great Canadian pre-Cambrian shield, the basement formation of the continent. It contains thousands of square miles and offers to prospectors better chances of locating valuable mineral deposits than can be found in any other country in the world. Turning from such a record and looking forward into the future, it requires no very vivid imagination to see other Cobalts and other Porcupines converting the wilderness into hives of thriving industry.

Arrangement of Water Tanks for Drifting Machines

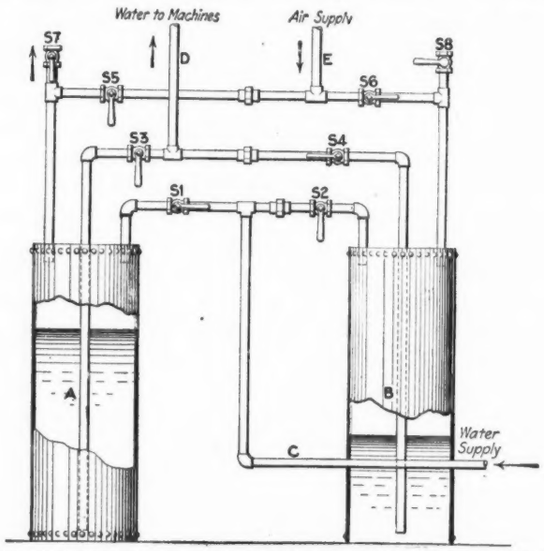
By H. H. Hodgkinson*

Water tanks arranged in the manner shown in the accompanying illustration are found to be of great assistance in driving drifts or tunnels where machines are used that require water passed through the drill steel. This method assures the drill runner of a steady supply of water having the same pressure as the compressed air. If the water pressure is greater than the air pressure, the cylinder of the machine soon becomes flooded. This reduces the speed of the drill and also washes all the lubricant out of the cylinder so that the drill finally stops. If the water pressure is lower than the air pressure, the sludge is not cleaned out of the drill hole properly. This not only cuts down the drilling speed, but may result in the loss of a drill steel from becoming stuck in the hole.

Delays in drifting are costly, but by the use of tanks arranged in this manner, it is never necessary for the drill runners to stop their drills for lack of water, it being only necessary to manipulate the four valves or stop-cocks on each tank. The drill runner is assured of good clean water without grit or dirt, which often causes a great deal of trouble, by plugging the water tube of the drill.

As the heading advances, pipe may be inserted between the tanks and the machines instead of moving the tanks each time. It is not necessary to remove the tanks when blasting the heading if they are placed at a safe distance.

The two tanks A and B are standard stock galvanized iron tanks made by any of the large drill manufacturers



ARRANGEMENT OF TWO INTERCHANGEABLE TANK TO SUPPLY NECESSARY DRILLING WATER

and have three holes in the top tapped for standard $\frac{3}{4}$-in. pipe fittings. Into these holes $\frac{3}{4}$-in. pipe is inserted, as shown, with the required unions, elbows, tees and eight $\frac{3}{4}$-in. stop-cocks. Stop-cocks are preferable to valves as they can be opened or closed more readily, show at a glance whether they are open or closed because of the position of the handle, and are less expensive.

The operation of the tanks is as follows: Assuming tank B supplying water to the drills, stop-cocks S_2 and S_8 are closed while S_4 and S_6 are open, allowing water to pass through pipe D and air through pipe E respectively. In the meantime water is passing through pipe C into tank A and the stop-cocks S_1 and S_7 are open. S_7 is to allow the air to escape from the tank as the water flows into it through S_1. Stop-cocks S_5 and S_3 are closed. When tank B is empty S_6 and S_4 are closed while S_8 and S_2 are opened, which permits the water from C to fill it. By closing S_7 and S_1 and opening S_3 and S_5, tank A will now supply the water.

Two tanks are necessary; while one is supplying water the other is being filled. It is also necessary to have a small supply of water, which can be piped to the tanks, having a head of at least 5 ft. so the water will flow into the tanks and overcome the friction of the connections.

*Mining engineer, care of United Verde Extension Mining Co., Jerome, Ariz.

Fairlie Process for Sulphuric-Acid Manufacture

An interesting method of controlling the working of a sulphuric-acid chamber plant has been patented by A. M. Fairlie; brief abstracts of the claims have already been published in U. S. Patents 1,205,723 and 1,205,724. A full description of the process was given by the inventor in a paper read before the Georgia Section of the American Chemical Society, which was published in the *Chemical Trade Journal,* Jan. 17, 1917.

It is well known that the largest single item of expense in operating a sulphuric-acid chamber plant is nitrate of soda. Efforts to improve the economical operation of such a plant are naturally directed, therefore, toward the conservation, or the recovery, of the valuable nitrogen compounds. The most important of the inventions designed to effect a saving in the consumption of nitrate of soda was of course the Gay-Lussac tower. Since the use of that tower for the recovery of the oxides of nitrogen escaping from the last chamber has become universal wherever the chamber process is in operation, many devices have been introduced to improve the efficiency of the tower. These include various styles of packing material, various ways of distributing the acid fed on the top, the use of water instead of steam in the chambers, the introduction of towers fed with cold acid between the chambers to effect greater cooling of the chamber gases, and so forth.

Efficiency of Guy-Lussac Towers

Even with the best of these improvements installed, the efficiency of the Gay-Lussac tower will depend largely upon the way the process is handled—upon the proper regulation of the streams of acid in the towers, and of the steam or water in the chambers; upon the efficient cooling of the acid on the Gay-Lussacs; upon the avoidance of interruptions due to breakdowns; and, above all, upon the careful introduction of just that amount of niter required for the oxidation of the sulphur dioxide admitted to the chambers per unit of time.

Let us assume that the plant has been designed and constructed intelligently—that proper materials of construction have been used; that spare pumping appliances have been provided to permit the uninterrupted flow of the streams of acid over the towers under any possible conditions; that bypass flues or spare fans have been installed to insure the continuous and uniform flow of gas even in case of breakdown; that the plant, in short, has been built under the direction of a competent sulphuric-acid engineer experienced in operation as well as in construction—let us assume further that the plant is manned by a competent crew of workmen able to operate the appliances without interruption, and turn our attention to the regulation of the niter in the system.

The well-known, time-tried methods of regulating the quantity of niter introduced, or, let us say, of controlling the process are: (1) By observing, the differences between chamber temperatures at different parts of the system, learning by experience what differences yield the best recoveries in the Gay-Lussac tower, and endeavoring thereafter to maintain such desirable temperature-differences constant; (2) by observing the color of the gases in the chambers or connecting pipes by means of windows or "sights," and (3) by a combination of both methods.

These methods may be satisfactory in the main, as long as the gas entering the Glover tower contains a substantially uniform percentage of sulphur dioxide, but it is questionable if, even under the best of conditions as regards uniformity of grade of burner gas, they are adequate to yield the most economical results. To control by these methods is to control by symptoms, whereas the rational method of control is by analysis of the gases. Certainly when the grade of burner or furnace gas is irregular, as in the case of plants manufacturing acid as a byproduct of zinc or copper-smelting operations, the time-tried methods of control should be replaced by the analytical method. The temperature-difference method fails, when operating on a fluctuating burner gas, because the indications of the temperature-differences are misleading. The same change in the temperature-difference may be due to one of several causes, and as the temperature-difference does not indicate in case of trouble to which cause the trouble is due, the wrong remedy may be applied. The color method alone is altogether inadequate as a guide for controlling the chamber process. In the first place, the sight glasses are usually placed at the back end of the chamber system, whereby information about the color of the chamber gases is obtained too late to prevent the damage which has been done; and besides, even if the sight glasses are in the front chamber, the color there is so obscured by the white mists that few persons possess the ability to detect the differences in shade, by day and by night, which would indicate whether or not the gas mixture contained the correct amount of nitrogen oxides.

The Fairlie method of controlling the chamber process is the only analytical method known to the industry. It has been in continuous daily use at the plant of the Tennessee Copper Co., where it was invented, for the past six years, and has proved its value every day that it has been in use. It consists in determining the percentage of sulphur dioxide in the chamber gases at some point near the front end of the chamber system, and in comparing such percentage with the percentage of sulphur dioxide in the burner gas, before admixture with niter fumes. The comparison shows, after experience, that a certain ratio between the two sulphur-dioxide percentages must be maintained in order to secure the best results in the Gay-Lussac tower. What this desirable ratio is must be determined for every possible grade of burner gas. Once determined, the desirable ratios are set down in tabular form on a card, which is framed and fastened in a convenient place for reference by the chamber operator. This operator keeps his analytical apparatus in good order at all times, and by taking frequent gas tests of the burner gas and of the front chamber gas, accurate indications as to the condition of the gas mixture and as to the speed of oxidation of sulphur dioxide are obtained, and obtained in time to apply the proper remedy in case anything is about to go wrong. An increase in the sulphur-dioxide ratio above what is desirable indicates the need of more niter; whereas a decrease below the desirable ratio indicates that the quantity of niter must be reduced.

The analytical method adopted for determining the sulphuric-dioxide percentage in the gases is the Reich method—in its original form for the burner gas, but modified by the addition of solution of acetate of soda and acetic acid to the absorption bottle, for the chamber

gas. The original unmodified Reich method is impossible for the chamber gas, because the presence of nitrogen oxides causes the starch-iodide blue color to recur and vitiates the results. The Reich method, as modified, will give results on chamber gas agreeing within 0.01%, and this is sufficiently accurate for the most careful control of the process. The method of testing the gases can easily be learned by a workman of usual intelligence, so that the expense of employing a chemist for the analysis of the gases is avoided.

Use of Modified Reich Method

It may be remarked in this connection that by means of the modified Reich method, as applied to chamber gases, important information may be obtained regarding the percentage of sulphur dioxide desirable in the gases entering the Gay-Lussac. Some of our old acid makers and, indeed, some of our old acid engineers, grown gray in the sulphuric-acid industry, scoff at the idea of any sulphur dioxide being desirable in the Gay-Lussac tower gases. This is because the older men are not familiar with any rapid method for determining accurately the percentage of sulphur dioxide in gas mixtures containing nitrogen oxides. And because the methods of analysis which they are used to failed to indicate the presence of sulphur dioxide at the Gay-Lussac tower, they have formed the conclusion that none is ever present, under normal conditions. The facts, however, are these: The nitrogen oxides are recovered most completely in the Gay-Lussac tower when the proportion of nitric oxide (NO) and nitrogen peroxide (NO_2) in the gases entering that tower are such that the combination gives nitrogen trioxide (N_2O_3) with no excess of either of the constituent gases. The presence of a small quantity of sulphur dioxide is needed in the gas mixture entering the Gay-Lussac to keep a sufficient amount of the nitrogen gases reduced to the nitric-oxide form. If the quantity of sulphur dioxide present be deficient or if there be none at all, an excess of nitrogen peroxide will be present above what is needed to combine with nitric oxide to form nitrogen trioxide, and this excess, being only slightly soluble in the cold 60° acid with which the tower is fed, will be lost, as indicated by the red fumes escaping into the air through the exit stacks. On the other hand, if too much sulphur dioxide be present in the gas mixture entering the Gay-Lussac, an excess of nitric oxide above the quantity needed to combine with the nitrogen peroxide to form the trioxide will be present. As nitric oxide likewise is only slightly soluble in cold sulphuric acid of 60° strength, this excess will be largely lost, as before, although because the nitric oxide is a colorless gas, the loss will not be so readily detected by observation of the color of the gases escaping from the top of the tower as in the case of the red gas, nitrogen peroxide. For this reason it is of especial importance to have some other means of knowing when there is an excess of nitric oxide present in the gases entering the Gay-Lussac. By means of the modified Reich test it has been demonstrated that the right proportions of nitric oxide and nitrogen peroxide will be present when the percentage of sulphur dioxide entering the Gay-Lussac is between 0.07 and 0.10% in cold weather, or between 0.09 and 0.12% in moderate or warm weather. Under moderate weather conditions any deviation in the percentage of sulphur dioxide above the high limit of 0.12% indicates an excess of nitric oxide, and any deviation below the low limit of 0.09% indicates an excess of nitrogen peroxide, so that careless handling of the process at the front end of the system will be plainly indicated by testing the gas at the entrance to the Gay-Lussac tower.

The analytical method of controlling the chamber process ought to eradicate that old advice to the chamber operator: "In case of trouble, first increase your niter at the pots, then find out what is wrong." This advice, advocated by two such authorities as Lunge and Falding, is, on the face of it, absurd. How foolish to add more niter in case of trouble, when the thing that is wrong may be already too much niter. The rational thing to do in case of trouble is to proceed by the indications of the analytical method. First find out what is wrong by analysis of the gases (30 sec. is all the time that is needed), then either increase or reduce the quantity of niter, according to indications.

The analytical method of controlling the chamber system is particularly valuable in starting up a set of chambers after a shutdown or in starting up a new plant for the first time. It has been the experience of most chamber-plant owners that in starting up a plant a period of experimentation must elapse, varying from two weeks for an old plant to several months for a new one, before the chambers settle down to regular work. The reason for this is that nobody knows, in starting up a plant, what is wrong, because the time-tried methods are useless while the process is upset. The analytical method of control, on the other hand, indicates precisely what is wrong and indicates to what extent it is wrong, thus permitting the proper remedy to be applied in the correct proportions. By means of the analytical method of control the immense plant of the Tennessee Copper Co. has been repeatedly put into regular working condition, after a shutdown, within 36 hours. The new 400-ton plant of this company, started for the first time in July, 1916, and using the analytical method of control from the start was in regular working condition 48 hours after the gas was first admitted to the Glover tower.

Note on Cadmium Precipitation

The *Chemist-Analyst* for Mar. 1, 1917, publishes the following, by R. R. Turner, on the subject of cadmium precipitation:

Having experienced difficulties in the separation of cadmium as sulphide in spelter analysis, I devised two years ago the following method for securing quick and complete separation of CdS with minimum contamination by zinc.

After a brief passage of hydrogen sulphide (one minute amply suffices) and without discontinuing the passage of the gas, one or two drops of ammonia are added to the solution. The separation of the CdS precipitate, starting from the point where the drops falls, spreads like a flash through the whole solution, which is in a supersaturated state with respect to CdS, and the precipitation is rapidly completed, requiring less than 15 min.

The precipitation is carried out in a solution containing 10% by volume of concentrated sulphuric acid, this degree of acidity being conducive to clean separation of cadmium from zinc.

The Platinum Mining and Milling Co., operating lessee of the Rambler mine, Holmes, Wyo., has resumed shipments of ores containing commercial amounts of platinum and palladium. Reports from the mine indicate an unusually severe winter.

Events and Economics of the War

During the last week the United States has been getting ready, but no formal announcement of plans has yet been made. On Apr. 15 the President issued a proclamation of advice and exhortation to the people, which is published in full in this issue of the *Journal*. Congress has passed the bill authorizing the borrowing of 7000 million dollars. The British and French commissions that are coming to discuss plans of coöperation are expected to arrive this week. The great military event of the week has been the continuation of the battle of Arras, which has spread along the whole line, with the French and British apparently victorious everywhere. The British won the outskirts of Lens, the great coal-mining center of the north of France. In retreating, the Germans continued to do great damage to property.

The National Press Bureau

Control of publicity in connection with the Government's war activities was placed by President Wilson, Apr. 14 in the hands of a Committee on Public Information, whose task will be to safeguard secrets of value from the enemy and at the same time to see that all affairs of the nation are laid before the people as fully and frankly as possible. Announcement of its creation was made in the following executive order:

"I hereby create a Committee on Public Information, to be composed of the Secretary of State, the Secretary of War, the Secretary of the Navy and a civilian who shall be charged with the executive direction of the committee. As civilian chairman of the committee, I appoint Mr. George Creel.

"The Secretary of State, the Secretary of War and the Secretary of the Navy are authorized each to detail an officer or officers to the work of the committee."

The President's action was based on the following letter, signed by the three Cabinet officers:

"Even though the coöperation of the press has been generous and patriotic, there is a steadily developing need for some authoritative agency to assure the publication of all the vital facts of national defense. Premature or ill-advised announcements of policies, plans and specific activities, whether innocent or otherwise, would constitute a source of danger.

"While there is much that is properly secret in connection with the departments of the Government, the total is small compared to the vast amount of information that it is right and proper for the people to have. America's great present needs are confidence, enthusiasm and service, and these needs will not be met completely unless every citizen is given the feeling of partnership that comes with full, frank statements concerning the conduct of the public business.

"It is our opinion that the two functions—censorship and publicity—can be joined in honesty and with profit, and we recommend the creation of a committee on public information. The chairman should be a civilian, preferably some writer of proved courage, ability and vision, able to gain the understanding coöperation of the press and at the same time rally the authors of the country to a work of service. Other members should be the Secretary of State, the Secretary of War and the Secretary of the Navy, or an officer or officers detailed by them.

"We believe you have the undoubted authority to create this committee on public information without waiting for further legislation, and because of the importance of the task and its pressing necessity we trust that you will see fit to do so.

"The committee upon appointment can proceed to the framing of regulations and the creation of machinery that will safeguard all information of value to an enemy and at the same time open every department of government to the inspection of the people as far as possible, Such regulations and such machinery will, of course, be submitted to your approval before becoming effective."

Hoover Accepts Administration of Food Supplies

Herbert C. Hoover, after consultation with his colleagues on the Commission for Relief in Belgium, accepted the chairmanship of the food board in the United States. Mr. Hoover expects to come soon to America. Meanwhile he has initiated a wide inquiry in France, England and Italy regarding the existing food situation, having the coöperation of the various governments in this work. Mr. Hoover made the following statement outlining his plans:

"Beginning today I am initiating a wide inquiry in France, England and Italy, in coöperation with government departments, into the existing food situation, prospects of the coming harvest, import necessities and the methods of regulating food control as at present in operation and their working results in allied countries.

"One important feature of this inquiry will be the methods used to control prices and for the elimination of speculation, for Europe has been a vast experimental laboratory in this particular. The staff of the relief commission which recently evacuated Belgium has volunteered to undertake the details of this investigation.

"The foremost duty of America toward her allies in this war is to see that they are supplied with food. France, England and Italy in ordinary times depended largely on Russia, Roumania and Bulgaria for a large portion of their breadstuffs. With the isolation of these areas they were thrown wholly upon the Western Hemisphere. The bumper Western harvest of 1915 was able to carry the load without a strain, but the more normal, or in places short, harvest of 1916, coupled with the fact that our allies are today giving their whole and ablebodied manhood to arms and the manufacture of munitions, has brought the whole allied world face to face with a shortage of breadstuffs. From the necessities of the case we can put but few soldiers in the field, but every spadeful of earth turned by our farmers, every seed we plant, every

ounce of waste we eliminate, is just as much a contribution to the joint cause as that of a man in the trenches.

"We must increase our production by every device of our able farming community, with the stimulating advice and guidance our agricultural institutions can invent, but beyond this we must stop waste in every scrap of foodstuff. We must even be prepared to deprive ourselves if necessary, in order that our allies may be supported. They have eliminated waste and are depriving themselves today, and it is not less our duty than theirs.

"If America will only eliminate waste and extravagance in food, it will go far to help the whole problem. Now that we are in the serious and terrible conflict, the very existence of our national ideas of waste and extravagance in public places and among certain classes in America is a public scandal. Beyond public places 85% of the American food is consumed in the houshold. The women of America thus really control America's food consumption.

"Among our allies the women are working as hard as the men. There is no body of women in the world so capable of rising to an emergency as American women, nor is there any problem so peculiarly capable of solution by them as the elimination of waste and extravagance. Much can be done by the substitution of the more abundant commodities for those that our allies need most. For instance, every person in America who eats corn bread instead of wheat bread helps in the present wheat shortage, for the English people have never learned how and have not the equipment to make corn bread, because they do not bake in the household at all and corn bread cannot be served from the baker.

Allies Must Have First Call on Food Supplies

"It is obvious that our allies must have first call on our food surplus. If we are to divert our man and woman power to furnish foodstuffs to neutrals, they must be compelled to give some equivalent service to our allies. They can furnish shipping or commodities or manufacturers which our allies need in return for food from us.

"Moreover, in this war against Germany we should allow no products of our labor or soil to go to any country or any peoples who assist Germany directly or indirectly. The supply of American corn to states bordering on Germany, which is converted into meal for German use, is depriving our allies of just that much food and benefiting our enemies.

"The war probably will last another year, and from the present outlook of the world's food supply we shall have all we can do, by the utmost elimination of waste and the utmost stimulation of production, to carry our allies through with their full fighting stamina.

"Nor can we allow speculation or profiteering to burden our own people with high prices. We must devise and enforce methods to reduce and maintain more reasonable prices, both for our own people and the Allies.

"All these are problems which the capacity and high ideals of self-sacrifice of the American people can accomplish smoothly and efficiently. Legislation and sumptuary regulations can accomplish far less than the voluntary self-denial and devotion of our people."

The New York office of the Commission for Relief in Belgium has received a cable message from Mr. Hoover, in which he declared that his action in accepting the chairmanship of the food committee of the National Council of Defense would not interfere with his work as chairman of the commission, and that he would retain both posts.

"Such a combination is distinctly desirable," says Mr. Hoover's message, "since there is bound to be considerable overlapping, particularly as to supplies and shipping."

Operation of the Railways

A board of railway executives, who will administer the transportation of troops and supplies throughout the United States for the duration of the war, was named Apr. 11 by the special committee on national defense of the American Railway Association. Members of the central executive committee are Fairfax Harrison, president of the Southern Ry.; Samuel Rea, president of the Pennsylvania; Howard Elliott of the New York, New Haven & Hartford; Julius Kruttschnitt, chairman of the executive committee of the Southern Pacific, and Hale Holden, of the Chicago, Burlington & Quincy. Daniel Willard, president of the Baltimore & Ohio and chairman of the advisory committee of the Council of National Defense, will be an ex officio member.

More than 50 railroad executives, representing 250,000 miles of American railways, were in attendance at the meeting which was called by Mr. Willard. The following resolution was unanimously adopted:

"Resolved, That the railroads of the United States, acting through their chief executive officers here and now assembled, and stirred by a high sense of their opportunity to be of the greatest service to their country in the present national crisis, do hereby pledge themselves, with the Government of the United States, with the governments of the several states and with one another, that during the present war they will coördinate their operations in a continental railway system, merging during such period all their merely individual and competitive activities in the effort to produce a maximum of national transportation efficiency.

"To this end they hereby agree to create an organization which shall have general authority to formulate in detail and from time to time a policy of operation of all or any of the railways, which policy, when and as announced by such temporary organization, shall be accomplished and earnestly made effective by the several managements of the individual railroad companies here represented."

What Russia Needs

Prince Lvoff, premier of the Provisional Council of Russia, said on Apr. 10 to Henry Suydam, correspondent of the *Evening Post:*

"Russia today needs administrative, mechanical, and engineering experts to assist in the vast work of reorganizing the muddle created by the old autocratic régime. We need war materials, especially railway rolling stock, in big quantities. We do not need fighting men, because we have millions in reserve.

"While news of the probable departure of American troops for France created intense enthusiasm throughout Russia, I believe that the most significant aspect of American intervention, so far as Russia is concerned, is not actual military but technical coöperation. We have in-

exhaustable human resources; you have expert directors and splendidly equipped factories to help us maintain our immense armies at their highest possible fighting efficiency. It is not men that Russia needs, but the means of keeping her armies at the front and in proper fighting trim, under efficient transport managers. We need railroad locomotives, cars and tracks, for example, as much as ammunition. We need railroad experts to deliver ammunition promptly at required points as much as we do artillery. We need American equipment under the direction of quick American methods."

The pressing need for extending aid to Russia, particularly by sending efficient engineers to build up railroads and other industries, has been called to President Wilson's attention in a letter from Michael M. Podolsky, a Russian engineer formerly connected with the Russian government and now living in Philadelphia.

"As every one knows," Mr. Podolsky wrote, "this war is a war in which the country most highly developed in engineering and technical matters is at an advantage. It seems to me that it would be helpful to Russia in the highest degree if the United States should organize a corps of several thousand efficiency engineers, of marked ability in all branches of engineering, and to pledge their assistance to Russia in increasing that nation's output of munitions, which is so sorely needed, and in assisting to direct the engineering projects on the Russian front."

List of Trades and Occupations of Primary Importance

The Reserved Occupations Committee of the British government has issued a list of trades and occupations which have been declared by the government to be of primary importance. The following occur in this list:

Mining and Quarrying—Coal mining. Patent-fuel works. Oil-shale mining, including shale-oil works. Iron mining and quarrying. Copper mining. Tin and wolfram mining. Lead mining. Fireclay and silica stone mining and quarrying. Ganister mining and quarrying. Limestone quarries (mainly supplying iron, steel or chemical works).

Metals, Machines, Implements and Conveyances—All classes of workers engaged in the manufacture of the following metals or their constituent parts from the treatment of the ore to the production of the metal in standard forms, such as ingot, billet, bloom, bar, rod, sheet or section: Aluminum, copper, iron, steel, lead, nickel, tin (smelting only), spelter, zinc and other metals (for example, tungsten, vanadium, wolfram) needed for war purposes, and their alloys (for example, brass, phosphor-bronze). Iron foundries and steel-smelting works and rolling mills. Electrical-accumulator manufacture and repairing. Scientific-instrument making. Slag-wool making.

Pottery and Glass Trades—Chemical ware (stoneware and fireclay) manufacture. Furnace firebrick (including ganister and silica brick) manufacture. Optical- and chemical-glass manufacture. Optical-lens and prism making. Other glass manufacture (except table and decorative ware and bottles for beer, wine, spirits and aërated waters).

Chemical, Oil, Etc., Trades—Coal-tar products, manufacture of. Dyestuffs, manufacture of. Explosives and propellants, manufacture of. Other chemical products, manufacture of. Lubricating oils and other lubricants, manufacture of. Oil-seed crushing. Soap and candles, manufacture of. Fertilizers, manufacture of.

Leather Trades—Hide and skin markets and fat and bone factories. Fellmongery. Tanning and currying of heavy leather. Leather transmission-belting manufacture.

Food Trades—Flour, oatmeal and rice milling. Machine creameries and condensed-milk and milk-powder factories. Margarine manufacture. Edible oils and fats, preparation of. Sugar refineries working under government.

Miscellaneous—Coke, manufacture of. Rubber trades. Waterproofing of fabrics for war purposes, and of paper.

Public Utility Services—Gas works. Water-works.

The State Must Support the Soldiers' Dependent Families

War is a Government function. The people declare it. The people pay for it. The sons of the people fight it. But the Government must conduct it says the New York *Sun*.

To fill our armies the state must take from their daily employment some millions of men. Many of these have families. The same Government which assumes the burden of clothing, housing and feeding its soldiers in the field must clothe, shelter and sustain the wives and children they leave behind.

Costly? Undoubtedly. War is a costly thing. But neither justice nor humanity will uphold a state which would ask its citizens to risk the perils of war and at the same time endure the torturing thought of loved ones left at home in destitution.

In our Spanish war, and again during the period of the detention of our citizen soldiers on the border, this righteous obligation of the Government was shifted to the shoulders of private citizens. The employers of the men called to the front were asked to pay all or a great part of their wages to their families while the wage earners were away. Most of them to their high credit, did so. But it was an unfair demand which the state should have been ashamed to make.

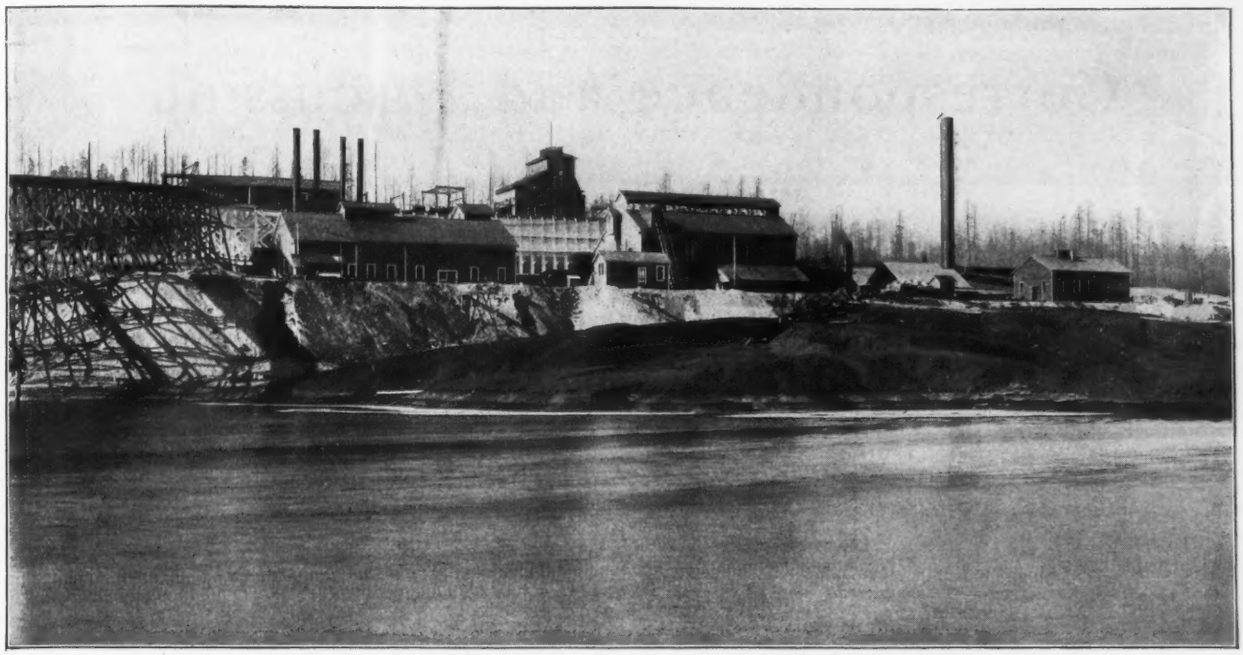
We should not repeat this blunder this year. At the outset official notice should be given that a subsistence allowance shall be made from the national treasury to the dependents of soldiers in the field. There should be no opportunity for the public to demand pledges from employers. Only gross injustice can come of voluntary assumption of this burden, just as gross injustice proceeds from voluntary military service in place of universal liability and conscription. The generous employer who continues to pay wages to his workmen with the colors will have to pay the same taxes as his niggardly neighbor who refuses such a contribution.

The whole matter should be covered by taxation. The sustenance of the soldier and the support of his family should alike be met from the public purse.

The countries that put the clock forward during the summer months are England, France, Australia, Germany, Austria, Denmark, Sweden, Norway, Italy, Holland and Portugal. In Canada, Nova Scotia has adopted the system and of our own cities Cleveland and Detroit.

Photographs from the Field

STEEL HEADFRAME AT STATE MINES NO. 4 SHAFT ON THE WITWATERSRAND GOLD FIELD



COPPER SMELTERY AT LADYSMITH, B. C., NOW BEING PUT IN SHAPE FOR RESUMPTION BY LADYSMITH SMELTING CORPORATION, OF VICTORIA, B. C.

U. S. BUREAU OF MINES MINE-RESCUE TRUCK NO. 3, USED IN THE STATE OF WASHINGTON

A fast White "three-quarter" truck, and six members of the mine-rescue corps, ready for action. The motor truck carries also emergency equipment such as oxygen tanks, pulmotors, fire extinguishers, hose, rope, compasses, drills, saws, shovels, picks and other mine tools, besides a private telephone and set of surgical dressings and instruments

Correspondence and Discussion

David H. Browne's Message to the Institutes

The successful career of the late Dr. David H. Browne and the eminence he had reached in his profession have been recorded by others. I wish to speak of the man himself and to convey to the American Institute of Mining Engineers, and also to the Canadian Mining Institute, a conclusion he had reached with respect to an enlargement of their field of operations.

Dr. Browne had emerged from long labors and struggles with a personality singularly free from those repressive and hardening effects that such experiences usually produce. Years had not shriveled his soul. His underlying strength of character and sanity of view were such that in developing the judgment of a man he had not lost the charm of youth. Approachability, capacity for new friendships, enthusiasm and creative power are not often found at fifty-three. When to these are added a sympathetic imagination that could project itself into the heart of a child and such a sense of moral duty that flaming indignation at the crimes of Germany had to express itself in active work for Belgium, the admiration and affection inspired in those who knew him may be understood.

The conviction that service for the common good is the duty next in order to the living problem of self and family was instinctive in such a man. His own processes had brought him to the practical conclusion that is common to all deep thinking in all ages. During the last few years residence in a great center with more command of his own time had presented increased opportunities for such service. Throwing his energies into these, one step led to another.

The first work to attract his attention was the problems of his own profession. How might he put new life into the American and Canadian Institutes? He tried to draw members into closer personal relations and to develop the social side of these organizations, but meanwhile their deeper problems grew upon him. The American Institute has more than attained the objects which its founders had in view forty-five years ago, but its own needs and those of the world about it have changed since then. Dr. Browne was one of those who believed that such an organization should move on to larger fields of usefulness, and he tried to ascertain what line of advance was most likely to meet the views of the membership. To this end he sought the opinions of others and discussed the problem from every standpoint, finally deciding that there was at least one line of procedure about which there need be no delay, as it would command an overwhelming support.

The Institutes, both the American and its sister society of Canada, should enter the active service of the public and of the government, but from the nature of the case the Institutes themselves must take the initiative in discovering and working out the best ways of serving. Every engineering and chemical society should build up such a relationship that its government will always turn to it for information and council in industrial problems.

This, then, is the message that Dr. Browne was seeking some way to present effectively to members. The crises in Belgian relief work just then called for his entire attention, and now with his death I feel authorized to present the message for him. Dr. Browne felt that the best procedure could easily be determined after a general discussion. The following is my own view of the principal conditions to be considered:

The service needed from a professional organization is entirely distinct from that given by the industrial corporations which sell to the public and to the government the products they need. Aside from its minor position as a purchaser the latter has, in behalf of the public, to regulate the operations of these producers and to decide upon legislation of all kinds affecting them, their employees and the mutual relations of the two. The government must also work out the technical improvements that are too general or too large for private enterprise. Under war conditions it must fill up the gaps and supply the deficiencies in industry and will assume more or less control of prices. Upon all such matters, pressing now and likely to become even more so after the war, independent, disinterested information is needed, and the engineers and chemists of the country are in the best position to supply this. Since governments are at best but clumsy and inefficient things, not yet sufficiently organized to recognize and supply all their needs, the initiative must come from the technical societies themselves. These will at first have to largely create their own jobs, finding out for themselves just where help is needed and persuading officials and legislators to let them give it. The fact that the United States has now entered the war will greatly lessen the difficulties anticipated in this work, since European experience has already shown the importance of mobilizing the technical knowledge of the country.

War, therefore, has presented an opportunity that should be utilized to the utmost. Under war conditions the desired relationship may be created promptly and then developed into a permanent one.

New York, Apr. 11, 1917. EDMUND B. KIRBY.

Protection of American Tungsten Industry

In the *Journal* of Dec. 23, 1916, is an article advocating the imposition of a duty to protect the American tungsten industry as the "tungsten miner of the United States cannot compete with the coolie labor in Burma, the bushman of Australia, the underpaid miner of Portugal, or the Indian of Peru or Bolivia." The only possible explanation is that this article is intended as a joke, though the humor of it takes a long time to grow on

one. The price appears to have increased in America from $6 or $7 per unit before the war to as much as $85 and now ranges from $17 to $20 (as quoted in the *Journal* columns). The British Government has commandeered the whole output of all its dependencies (including Australia and Burma) so that at present the Australian bushman or the Burmese coolie does not enter into competition with your ill-used contributor. At the same time the price is arbitrarily fixed at less than $12, so that even were competition allowed there would be about 50% protection against these objectionable competitors. And the "Australian bushman" has the nerve to grumble because his government has been paying foreigners (our friend, the American tungsten industry, for instance) two or three times as much as it is paying its own subjects for this mineral! For the benefit of your contributor I would explain that in Australia, "bushman" means "countryman." "Bush" originally meant "forest," but now means any part of the country, and as mines are usually away from towns, one might even thus call a miner a bushman. Has our friend some confused notion of African bushmen?

The wages of wolfram miners here are doubtless as high as those in the United States and decent men are at present very difficult to get, practically all fit men having enlisted and gone to the front. Also machinery and stores of all sorts are scarce and dear, high-power explosives are prohibited (on account of the war) so that mining costs are doubtless quite as high as in America. Besides, we are always told to look to America for low costs and efficiency in mining; indeed, T. J. Hoover tells us that operations in America as compared with the same in Australia would probably be 25% cheaper, even though the cost of materials would be about the same and wages much higher. "On the other hand," he says, "labor is doubly efficient and the difference in management beyond power of figures to express." With the evidence of such an authority as to their immense superiority, the tungsten miners of the United States should not be afraid of our competition—they should not even be afraid of the underpaid miner of Portugal or the Indian of Peru or Bolivia. Of course all this explanation may not be necessary, and your contributor will doubtless be amused at the successful way in which he has pulled my leg. JAMES B. LEWIS.

Melbourne, Victoria, Feb. 15, 1917.

Minerals Separation's Policy

Referring to the policy of Minerals Separation toward infringers and recent criticism that has been launched against it by certain interests, it seems to me that a spirit of get-together, rather than antagonism, might induce both the party of the first part and the party of the second part to be more reasonable.

In respect to the "Cascade" flotation apparatus, mentioned in the Denver correspondence of the *Journal* of Feb. 24, 1917, as having been developed and used at the Mineral Farm mill at Ouray, Colo., I think it right and proper also to state that recently Minerals Separation North American Corporation, through its chief engineer, has written me a letter completely wiping out the Mineral Farm "infringement" and allowing me a clean slate. Future operations will be under license, and I am assured this license will be made reasonable. This letter also states that the policy will be to treat past infringers, who have operated their milling plants in an experimental manner or have made no remarkable financial improvement, with all leniency and consideration.

In short I feel that I have been well treated and believe, from the tone of its letters, that this corporation intends to carry out a decent and reasonable policy.

Ouray, Colo., Mar. 6, 1917. C. R. WILFLEY.

Gelatin Dynamite in the Tropics

Considering the almost prohibitive price, since the early part of 1915, of gelatin dynamites and their extensive use in the tropics, it would appear that users have a prejudice against any possible substitute. The absence of discussion of the subject in the columns of the *Engineering and Mining Journal* prompts me to submit, in the interest of users of explosives, especially in the tropics, the results obtained here from the use of "Atlas Low-Freezing Extra Dynamite," which was supplied by the manufacturers together with a statement that they could not guarantee that it would even explode in the tropics. Its use here has demonstrated a number of points of superiority over straight gelatin, of which the following may be mentioned: Cost, 33-45% less; breaks more of any kind of rock encountered here; no misfires reported; submergence in flowing water for 48 hours did not affect its sensitiveness or strength; shows no signs of deterioration after 4 months' storage, without turning boxes.

Summing up, it appeals to us here as being a perfect powder. To be more in agreement with its use in the tropics, its name might be changed to "Low-Melting Extra Dynamite." L. DRAPER.

Topaz Mining Co., Care of Belanger's Inc.,
Bluefields, Nicaragua, Mar. 13, 1917.

Metal Mining in Russia

In reading the proof of the article on "Metal Mining in Russia," in the *Journal* of Mar. 10, the senior author neglected to note the following typographical errors: Page 405, column 1; "Semipalatinsky," not "Semipalatinsy." Page 407, column 1; "Ferromagnesian," not "Ferromanganesian." Page 408, column 1; "Beklorechensk," not "Beklorechnsk." Page 409, column 1; "Pashkoff," not "Paskiff." Page 410, column 2; "Dzansul," not "Dazansul." Page 411, column 2; 16th line from bottom; "Co," not "Cu."

I would be glad to have these corrections noted.

New York, Mar. 15, 1917. SIDNEY H. BALL.

How Does a Divining Rod Work?

We find among the relics of this place, an "F. H. Brown electrical geodetic mineral finder." Can you refer us to anyone who would know how the thing works?

This is our first opportunity to experiment with a divining rod, and as the instrument is rather elaborate and well assembled, we would like to ascertain how it is supposed to work; if we could do so, we could have some amusement out of it. S. H. BROCKUNIER.

Cordova Mines, Ltd., Cordova Mines, Ont.,
Mar. 19, 1917.

Chino Copper Co.

The annual report of the Chino Copper Co., of New Mexico, for 1916 shows the net operating profits to have been $12,517,876 and miscellaneous income $325,285, a total of $12,843,161, or $14.76 per share, as compared with $7.95 per share for 1915. Dividends aggregating $8.25 per share were paid during the year to the holders of 869,980 shares of stock outstanding. Surplus amounting to $5,350,613 was passed to earned surplus, after $315,213 was set aside for depreciation of plant and equipment.

The total earned surplus as of Dec. 31, 1916, aggregated $13,936,873. The surplus from sale of securities over par value remained as in the previous year, $2,995,252.

Mining Development and Ore Reserves

Churn drilling was continued throughout the year, the drills being moved from the Northwest orebody to the Sierra section in order to define the extension of this area to the east and to give data as to the intersection of the stripping slopes between this orebody and the Hearst pit. The total drilling for the year was 13,161 ft. Since the beginning of operations there has been a total of 227,303 ft. drilled.

A recalculation of ore reserves as of Dec. 31, 1916, showed the developed ore remaining in and on the property at that time to be 95,555,843 tons, containing an average of 1.656% copper. Of this quantity, 94,490,936 tons, averaging 1.655% copper, remained unmined. The remainder, amounting to 1,064,907 tons, consisted of mixed sulphide and carbonate ore stored in stockpiles, and contained an average of 1.81% copper. This ore was so stored because it was not amenable to concentration by the methods regularly employed, but facilities for the treatment of this class of material are now being provided. The total amount of ore developed and reported from time to time since the beginning of operations, including that now reported, is 106,081,263 tons, having an average grade of 1.694% copper. The total of ore mined since mining began amounts to 11,590,327 tons, having an average assay of 2.01% copper. Of this quantity, 10,487,000 tons, averaging 2.02% copper, has been milled, and 22,343 tons, averaging 6.69% copper, has been shipped to the smeltery. The remainder represents ore stored in mine stockpiles, on hand in coarse-crushing plant and mill bins and in transit between mine and mill. The ore added to reserves as a result of developments for the years 1915 and 1916 average 1.35% copper. Of the total ore reserves stated as remaining, it is estimated that 81,765,279 tons, will be mined by steam shovels and 13,790,564 tons by underground-mining methods. Since the beginning of operations the tonnage of ore actually milled or shipped direct to the smeltery represents 9.92% of the total amount of ore developed, which corresponds to 11.27% of all the ore estimated as being available for steam-shovel mining. At the same time there had been removed an amount of capping equivalent to about 26% of the quantity it will be necessary to strip in order to uncover and recover the total developed tonnage. In revising the estimates of ore reserves, an entirely new set of calculations was made as applying not only to newly developed areas, but as well to previously developed and now partly mined areas. In the latter it was found necessary to make corrections in the way of some reductions in good-grade tonnage as compared to the figures shown in former estimates, because steam-shovel operations up to date have been quite largely conducted over areas that had previously been mined to a considerable extent through shallow underground workings. In preparing original estimates there was no means available for making allowance either as to quantity or copper content for the tonnage that had been so removed, and the partly mined blocks were therefore calculated as solid ore. Practically all the zones containing these old workings have now been removed, so that discrepancies from this cause will not occur again.

The total ore and waste removed by steam shovels during the year was 5,300,891 cu.yd. of material in place. Of this amount 3,564,623 cu.yd. was stripping, the remainder, equivalent to 3,216,065 tons, being ore. Of the ore that was removed, 3,095,466 tons was shipped to the mill and 646 tons direct to the smeltery. The rest was stored on the ore dumps. The ore sent to the storage dumps consisted in part of lower-grade material encountered by the steam shovels at times when the mill was not prepared to receive it, and in part of oxidized ores such as have since the beginning of operations been stored for future treatment.

From the beginning of steam-shovel operations on Sept. 23, 1910, there has been removed a total of 22,795,332 cu.yd. of material in place, of which 16,886,785 cu.yd. was stripping, the remainder being equivalent to 11,586,692 tons of ore. Of this ore, 1,064,907 tons has been stored in the stockpiles at the mine. Of the remainder, 10,501,855 tons was shipped to the mill, the remainder having been shipped directly to the smeltery. The average cost for the steam-shovel operations in the removing of both ore and stripping during the year was 37.97c. per yd., as against 35.28c. per yd. for the year 1915. This represents an increase equivalent to 7.62%; whereas the increased cost of labor, supplies and taxes was in terms of percentage several times as great. The cost of handling waste alone was 38.82c., an increase of 13.24%, or 4.54c. per yd. over the cost of 1915. The cost of mining ore was 19.88c. per ton, this being only 2.1% greater than for 1915. The small advance in the cost of mining ore, notwithstanding the greatly increased cost of labor and supplies, was due to the greater efficiency of the train service and the benefit of the primary crushing plant. Of the ore production for the year shipped to the mill, 5.2% came from the Northwest orebody, 19.7% from the North orebody, 74.5% from the South orebody and 0.6% from the Southwest orebody.

Construction and Improvements at the Mill

Following the completion at Hurley of the mill and its accessories, which were originally built for a capacity of 5000 tons per day, improvements in operating methods were applied from time to time tending principally toward increase of tonnage. During the first half of the year 1914 the plant handled an average of about 6500 tons per day. Then came the enforced restriction of operations covering a period of several months, during which time only limited expenditures for improvements were made. After full tonnage operations were resumed

in 1915, a still more active campaign of betterments was inaugurated, having for its purpose not only the increase of tonnage, but the improvement of metallurgy. During the last half of 1915 the plant treated an average tonnage more than 50% in excess of its original capacity. This was made possible by the extension of facilities in the concentrating department, which resulted at the same time in some increase of recoveries. With the beginning of 1916 the power requirements of the mill and mine were rapidly approaching the maximum output of the power plant, and it was decided to install an additional turbo-generator of a size such as to practically double the safe working capacity of the plant and thus provide a reserve against possible accident to any of the units. The necessary machinery and accessories were ordered in January of 1916 for delivery in August, but the first of the apparatus was not received until late in the year, and further delays in deliveries will make it impossible to have the full plant in operation much before the middle of 1917. In the meantime further additions and improvements were made in the concentrating department. An entirely new slime-settling and water-recovery system was designed and is now partly completed. A filter plant was constructed for handling fine slime concentrates, and the original mill was, through all these betterments, brought up to the maximum capacity attainable except by the installation of additional grinding machinery. Throughout the latter half of the year mill operations were hampered not only by the interference of alterations and construction, but by lack of an adequate power supply. Notwithstanding this the average tonnage for the year 1916 was substantially in excess of that for the period of full-capacity operations in 1915.

Increase in Capacity

In the first quarter of 1916 it was decided to still further increase the capacity of the plant by the addition of two new sections, thus contemplating the first additions of any consequence to the original mill building. One of these sections and a part of the other will supplement the original mill equipment by an extensive installation of fine-grinding machinery as well as additional concentrating machinery for the treatment of the regular class of sulphide concentrating ores. A part of the second section will be set aside for treating the accumulated stock of partly oxidized ores as well as future production of this class of ore until it is exhausted, after which this section as a whole may be readily converted to the treatment of ores of the normal concentrating variety. Material was not ordered and active construction begun on the two new sections until late in 1916. At the end of the year the work was well under way, and it is expected that a part of the first new section will be in operation during the second quarter of 1917, but on account of the difficulty in securing construction material it is not probable that the full benefit of the two new sections will be realized much, if any, before the end of the year. It is estimated that the seven-section plant, when completed, will have a capacity of about 12,500 tons per day, corresponding to an increase of about 40% above the capacity of the present five-section plant. About 1000 tons per day of the increased capacity will be used for the accommodation of partly oxidized or mixed carbonate and sulphide ores. Late in the year 1916 an experimental plant of 100 tons daily capacity was constructed for the purpose of working out improved methods for application to the treatment of all classes of ores. The operation of this plant is affording valuable information from experimental and investigative work without interfering with the tonnage or results of regular milling operations. Investigations covering a period of several months in 1915 and the early part of 1916 indicated that the accumulation of several million tons of mill tailings could be retreated at a profit. A tailings retreatment plant of 1000 tons daily capacity has been constructed, and is now practically ready for operation.

Mill Operation

For the year 1916 there was treated in the mill at Hurley a total of 3,094,400 tons of ore, equivalent to an average of 8455 tons per day. Previous to June 1 the highest tonnage treated in the mill in any one day was 9600 tons. In June a maximum of 10,200 tons was attained, after which month the average for periods of several days frequently reached and at times exceeded that figure. This large increase in tonnage was accomplished through changes in the details of milling practice and through mill improvements that have been in progress for about two years and were still uncompleted at the close of the year. During the last eight months of 1915 the mill averaged 7865 tons per day, accordingly the increase in capacity for the year 1916 was 14.55%. The improvements introduced during 1915 and 1916 increased the mill's capacity a total of 31.55% over the best former record, which was the first seven months of 1914. This was accomplished in spite of the fact that during the whole of 1916 the work of construction and alteration interfered considerably with milling operations. The average content of the ore treated for the year was 1.83% copper, or 0.32% lower than for 1915. The total production of concentrates was 254,852 tons, which averaged 14.82% copper. The total amount of copper contained in the concentrates was 75,551,376 lb., corresponding to a recovery of 24.42 lb. of copper per ton of ore and representing an extraction of 66.59%, which was practically the same as that for the year 1915, notwithstanding the increase of tonnage and lower grade of ore. The average milling cost for the year was 64c. per ton, an increase of 9.81c. over that for 1915, equivalent to 18.1%, which again is much below the percentage increase of labor, supplies and taxes.

During the year there was shipped from the mine direct to the smeltery 524,734 dry tons of ore and 121,769 dry tons of precipitates containing 210,602 lb. of copper.

The production of copper contained in concentrates and other shipping products for the year, by quarters, was as follows:

	Lb.
First quarter	16,350,348
Second quarter	18,157,923
Third quarter	20,650,761
Fourth quarter	20,602,946
Total for year 1916	75,761,978

The average cost of the stated net copper produced for the year, after making deductions for smelter allowances and after crediting precious-metal values and miscellaneous income, was 8.7c. per lb., as compared to 6.75c. per lb. for the previous year. The credit for precious metals amounted to 0.11c. per lb., and that for miscellaneous income to 0.45c. per lb., a total of 0.56c. per lb. The per pound cost stated includes operating expenses and charges of every nature except depreciation.

Rand Mineral Production

By A. Cooper Key*

SYNOPSIS—The gold output of the Transvaal in 1916 constitutes a record, and the recovery per ton was higher than in 1915. Working costs advanced 5d. per ton, profits and dividends are diminishing.

The total gold output of the Transvaal for 1916, as returned by the Chamber of Mines, is £39,484,934 and constitutes a record, the previous highest being the £38,711,581 of 1912. Compared with the previous year there is an advance of £857,473. The recovery per ton of ore crushed was 5d. higher at 26s. 9d., and this figure applied to the tonnage would account for about £606,000 of the increase. The tonnage crushed throughout the Transvaal was 191,690 additional at 29,175,468, which would represent rather over £250,000. The Rand output of £38,107,909 was again (as in 1915) a record, the increase being £842,917. Taking the Rand mines by themselves, there was an increase of 210,673 in tonnage. This is by no means so large an increase as that shown in 1915, namely, 2,612,585 tons, which period benefited so largely by initial returns from the Government Areas and Modder Deep. It is interesting to notice that the tonnage crushed was more than double that in 1906.

Working Costs Rise to 18s.

It may be recalled that in 1915 working costs advanced 4d. per ton, it being only in the later half of the year that the rise in the price of stores was felt at all seriously. This last year there has been a further advance of 8d. to 18s. 1d., the highest figure since 1912 and with that exception, since 1907. With a field crushing 2,350,000 tons a month, as does the Rand, a few pence per ton amount in the aggregate to a very large sum. The actual rise which has taken place represents £950,000 for the year. Collated figures show that the mines of the Rand expended £25,763,000, compared with £24,657,500, an increase of £1,106,000, an additional 210,600 tons being crushed. If we take the mines of the outside districts into consideration also, the total expenditure exceeded £26,550,000. Owing to the enhanced tonnage and better grade, Rand profits were only £300,000 less than for 1915. The total was £11,630,000. On the unit basis, the rate was 8s. 2d. instead of 8s. 5d. and contrasting with 9s. in 1914, 9s. 6d. in 1913, and a level half-sovereign in 1912. Mines of the outside districts made an aggregate profit of £251,300, or only a few thousands less than in 1915, when those mines made £170,000 less than for 1914. Both the Nigel and the Sheba have for months sustained losses. Some measure of the growth of expenditure may be had from the fact that last year's total was within £700,000 of the entire Rand output in 1907.

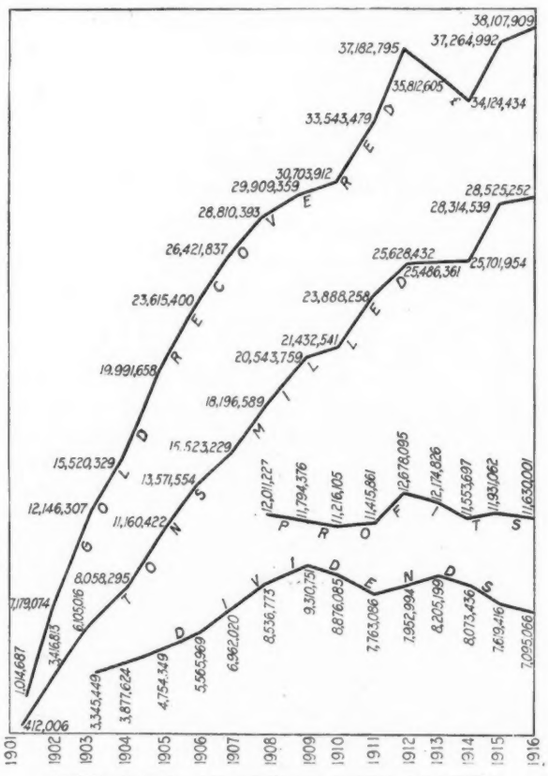
Internal Financing Necessary

The fact that the British Treasury prohibits new issues of capital for gold mining ventures—and that is broadly the position—has caused the industry to find such funds from internal sources to an even greater extent than previously. Much larger quantities of stores are held as a very necessary assurance against irregularity in shipments, which an interval of a month between mails from England brings forcibly home to the general public. The great Randfontein Central company was in a position to have paid a 5% dividend, which would have amounted to £225,000, but the Barnato group, to which the control has passed, decided that it was best to conserve the company's resources. Both 1915 and 1916 had to bear the special war levy of £500,000.

These factors explain why the gap between working profits (£11,630,001) and dividends actually declared (£7,095,935) is wider than usual. It figures at no less than £4,534,935, compared with £4,313,500 in 1915. In the following table are contrasted the dividends and working profits:

	Profits	Dividends
1911	£11,415,861	£7,763,086
1912	12,678,095	7,952,994
1913	12,174,826	8,205,199
1914	11,553,697	8,073,436
1915	11,931,062	7,617,561
1916	11,630,001	7,095,066

Even a glance at the diagrams accompanying this article will show that shareholders are not getting any proportion of the greatly augmented production of the past



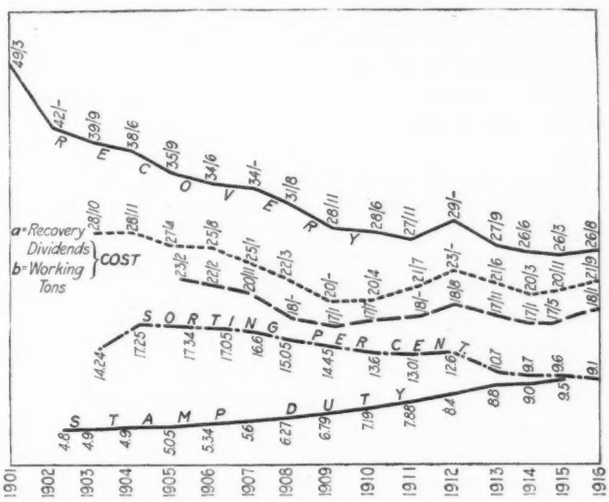
COMPARISON OF OUTPUT WITH PROFITS AND DIVIDENDS

few years. While the output line is steadily going upward, the profits and dividend lines are falling or, at best, level, according to the period taken for comparison. Since 1908, when the Chamber of Mines first collated profits, the gold production has increased by £8,200,000, but the profits are actually somewhat less than in that year. In 1916 shareholders had perforce to be content with a little over seven millions in dividend distributions; in the year mentioned the payments exceeded eight and

*Box 3626, Johannesburg, South Africa.

a half millions. It cannot be said that mine shareholders are having the time of their lives. While the position is eminently sound from a productive standpoint, as also from the Imperial viewpoint, it is much less satisfactory to shareholders. Last year we drew attention to the intensely discriminating character of recent market activity, and now that another has passed, we may describe it as the essential feature of 1916. Notice how many shares of older mines are now in the region of par, though still paying good dividends.

In the circumstances reviewed, it will be easily realized that the difference between dividends and production, always a very drastic method of indicating working costs, and with so many items over and above those charged to working costs now entering, no longer a reliable method, will represent a high figure per ton. In point



COMPARISON OF RECOVERY WITH SORTING AND STAMP DUTY

of fact it is no less than 21s. 9d. per ton, or 10d. in advance of the figure in 1915 or 2d. per ton more than the rise in working costs as determined by the Chamber of Mines. The difference of 3s. 8d. represents such items as profits tax, claim licenses, war levy, capital expenditure defrayed out of revenue, payments of accumulated debt, and, by no means an insignificant item, debenture interest and redemption, miners' phthisis compensation, etc.

Monel Money for Canada

A startling proposal was made recently by Prof. Stephen Leacock, famed alike as a teacher of political economy at McGill University and as a literateur, to the effect that the Canadian silver coinage should be replaced by one of nickel, thus saving to the country the difference in cost of these metals, which would amount to millions of dollars. The expected saving, however, would not be a clear profit, says the *Bulletin* of the Canadian Mining Institute, for the silver coins now in use serve their part in maintaining the value of the currency and if withdrawn would have to be replaced by equivalent gold or silver bullion in the government vaults; but a recent suggestion has been made that the elusive 5c. piece should at least be replaced by a coin that could be handled more easily and that could be distinguished with less difficulty from the 10c. piece.

The proportion of nickel in the nickel coins in circulation in the United States is only 25%, while that of copper is 75%. Such an alloy contains enough nickel to make it white and hard enough for use. To make the coins of pure nickel would be wasteful of that metal, apart from the fact that the nickel-copper alloy is more easily melted and coined. It has previously been suggested in the *Bulletin*, however, to make at a very reasonable cost, a 5c. coinage out of monel metal (the natural nickel-copper alloy containing 70% of nickel and 30% of copper), and this would give something distinctively Canadian at a cost decidedly less than if pure nickel were employed. This alloy is nearly as strong as steel, is noncorroding and has a good white color. With silver at 75c. an ounce and copper at 30c. a pound, a 5c. silver coin would contain 2.6c. worth of silver and 0.006c. worth of copper, or 2.606c. in all. The United States "nickel" coin contains 0.25c. worth of copper and 0.15c. worth of nickel (with nickel at 55c. a pound) or 0.4c. in all. The saving amounts to 2.2c. per coin; 44c. per dollar's worth of coins; or $92,400 on the 5c. pieces coined in Canada in 1916. A monel 5c. piece, although containing a large proportion of nickel, would probably not cost more to produce than an American "nickel."

A Labor Lesson from Australia

In December, 1916, twelve members of an association known as the Independent Workers of the World, says the *South African Mining Journal*, were sentenced in Sydney to various terms of imprisonment ranging from fifteen to five years, on charges of conspiracy against the peace and good order of the realm. In passing sentence, the judge expressed the hope that "very strong and drastic steps would be taken to root out that association," which he had no hesitation, on the evidence laid before the court, in describing as "an association of criminals of the very worst type and a hotbed of crime."

Mr. Hughes lost no time in taking the hint, and the last Australian mails record the passage through the Federal House of Assembly of a bill proscribing the Independent Workers of the World as an illegal association and arming the state with powers adequate to enable the government to deal promptly and drastically with similar associations in the future. There is reason to suppose that the society has had its adherents in South Africa. In New Zealand some of the more ardent spirits among the "Red Feds," who caused so considerable an upheaval a few years ago, were unquestionably imported agents of the Independent Workers of the World; and in recent years the movement has been spreading in Australia, with results that have been painfully emphasized in the recent happenings in Sydney.

"The principle underlying the whole business," in Mr. Hughes' words, "was that it was through a complete paralysis of industry alone that the economic salvation of the working class could be effected. Any fancied injury done to one section was to be taken to be done to all. The general strike, in effect, was an open declaration of war upon society." The principle of the general strike has been tentatively applied in Belgium, in New Zealand, in Australia and in South Africa. The association's agents included the sweepings of all the prisons in Europe and America, and according to Mr. Hughes, evidence is available proving that as an organization the I. W. W. was being employed deliberately against the interests of Great Britain and the Allies.

President Wilson's Proclamation to the American People

President Wilson, on Apr. 15, made the following address to the people of the United States:

My Fellow Countrymen:

The entrance of our own beloved country into the grim and terrible war for democracy and human rights which has shaken the world creates so many problems of national life and action which call for immediate consideration and settlement that I hope you will permit me to address to you a few words of earnest counsel and appeal with regard to them.

We are rapidly putting our navy upon an effective war footing and are about to create and equip a great army, but these are the simplest parts of the great task to which we have addressed ourselves. There is not a single selfish element, so far as I can see, in the cause we are fighting for. We are fighting for what we believe and wish to be the rights of mankind and for the future peace and security of the world. To do this great thing worthily and successfully we must devote ourselves to the service without regard to profit or material advantage and with an energy and intelligence that will rise to the level of the enterprise itself. We must realize to the full how great the task is and how many things, how many kinds and elements of capacity and service and self-sacrifice it involves.

Things to be done Besides Fighting

These, then, are the things we must do and do well, besides fighting—the things without which mere fighting would be fruitless.

We must supply abundant food for ourselves and for our armies and our seamen not only; but also, for a large part of the nations with whom we have now made common cause, in whose support and by whose sides we shall be fighting.

We must supply ships by the hundreds out of our shipyards to carry to the other side of the sea, submarines or no submarines, what will every day be needed there and abundant materials out of our fields and our mines and our factories with which not only to clothe and equip our own forces on land and sea but also to clothe and support our people for whom the gallant fellows under arms can no longer work; to help clothe and equip the armies with which we are coöperating in Europe and to keep the looms and manufactories there in raw materials; coal to keep the fires going in ships at sea and in the furnaces of hundreds of factories across the sea; steel out of which to make arms and ammunition both here and there; rails for worn out railways back of the fighting fronts; locomotives and rolling stock to take the place of those every day going to pieces; mules, horses, cattle for labor and for military service; everything with which the people of England and France and Italy and Russia have usually supplied themselves but cannot now afford the men, the materials or the machinery to make.

It is evident to every thinking man that our industries, on the farms, in the shipyards, in the mines, in the factories, must be made more prolific and more efficient than ever and that they must be more economically managed and better adapted to the particular requirements of our task than they have been: and what I want to say is that the men and the women who devote their thought and their energy to these things will be serving the country and conducting the fight for peace and freedom just as truly and just as effectively as the men on the battlefield or in the trenches.

The industrial forces of the country, men and women alike, will be a great national, a great international service army—a notable and honored host engaged in the service of the nation and the world, the efficient friends and saviors of free man everywhere. Thousands, nay, hundreds of thousands of men otherwise liable to military service will, of right and of necessity, be excused from that service and assigned to the fundamental sustaining work of the fields and factories and mines, and they will be as much part of the great patriotic forces of the nation as the men under fire.

An Appeal to the Farmer

I take the liberty, therefore, of addressing this word to the farmers of the country and to all who work on the farms. The supreme need of our own nation and of the nations with which we are coöperating is an abundance of supplies and especially of foodstuffs.

The importance of an adequate food supply, especially for the present year, is superlative. Without abundant food, alike for the armies and the peoples now at war, the whole great enterprise upon which we have embarked will break down and fail. The world's food reserves are low. Not only during the present emergency but for some time after peace shall have come both our own people and a large proportion of the people of Europe must rely upon the harvests in America.

Upon the farmers of this country, therefore, in large measure rests the fate of the war and the fate of the nations. May the nation not count upon them to omit no step that will increase the production of their land or that will bring about the most effectual coöperation in the sale and distribution of their products?

The time is short. It is of the most imperative importance that everything possible be done and done immediately to make sure of large harvests. I call upon young men and old alike and upon the able-bodied boys of the land to accept and act upon this duty—to turn in hosts to the farms and make certain that no pains and labor is lacking in this great matter.

To the Farmers of the South

I particularly appeal to the farmers of the South to plant abundant foodstuffs as well as cotton. They can show their patriotism in no better or more convincing way than by resisting the great temptation of the present price of cotton and helping, helping upon a great scale, to feed the nation and the peoples everywhere who are fighting for their liberties and for our own. The variety of their crops will be the visible measure of their comprehension of their national duty.

The Government of the United States and the Governments of the several States stand ready to coöperate. They will do everything possible to assist farmers in securing an adequate supply of seed, an adequate force of laborers when they are most needed at harvest time,

and the means of expediting shipments of fertilizers and farm machinery, as well as of the crops themselves when harvested.

The course of trade shall be as unhampered as it is possible to make it and there shall be no unwarranted manipulation of the nation's food supply by those who handle it on its way to the consumer. This is our opportunity to demonstrate the efficiency of a great democracy and we shall not fall short of it.

This let me say to the middlemen of every sort, whether they are handling our foodstuffs or our raw materials of manufacture or the products of our mills and factories. The eyes of the country will be especially upon you. This is your opportunity for signal service, efficient and disinterested. The country expects you, as it expects all others, to forego unusual profits, to organize and expedite shipments of supplies of every kind, but especially of food, with an eye to the service you are rendering and in the spirit of those who enlist in the ranks, for their people, not for themselves. I shall confidently expect you to deserve and win the confidence of people of every sort and station.

To the men who run the railways of the country, whether they be managers or operative employees, let me say that the railways are the arteries of the nation's life and that upon them rests the immense responsibility of seeing to it that these arteries suffer no obstruction of any kind, no inefficiency or slackened power.

Small Profits and Quick Service

To the merchant let me suggest the motto: "Small profits and quick service"; and to the shipbuilder the thought that the life of the war depends upon him.

The food and the war supplies must be carried across the seas no matter how many ships are sent to the bottom. The places of those that go down must be supplied and supplied at once.

To the miner let me say that he stands where the farmer does; the work of the world waits on him. If he slackens or fails, armies and statesmen are helpless. He also is enlisted in the great service army.

The manufacturer does not need to be told, I hope, that the nation looks to him to speed and perfect every process; and I want only to remind his employees that their service is absolutely indispensable and is counted on by every man who loves the country and its liberties.

Let me suggest also that every one who creates or cultivates a garden helps and helps greatly to solve the problem of the feeding of the nations and that every housewife who practices strict economy puts herself in the ranks of those who serve the nation.

This is the time for America to correct her unpardonable fault of wastefulness and extravagance.

Let every man and every woman assume the duty of careful, provident use and expenditure as a public duty, as a dictate of patriotism which no one can now expect ever to be excused or forgiven for ignoring.

In the hope that this statement of the needs of the nation and of the world in this hour of supreme crisis may stimulate those to whom it comes and remind all who need reminder of the solemn duties of a time such as the world has never seen before, I beg that all editors and publishers everywhere will give as prominent publication and as wide circulation as possible to this appeal. I venture to suggest, also, to all advertising agencies that they would perhaps render a very substantial and timely service to the country if they would give it widespread repetition, and I hope that clergymen will not think the theme of it an unworthy or inappropriate subject of comment and homily from their pulpits.

The supreme test of the nation has come. We must all speak, act and serve together.

Woodrow Wilson.

Foreign Trade in Lead and Zinc

Imports of lead and zinc during February, 1917, are reported by the Department of Commerce as follows:

Articles and Countries	Contents, Lb.
Lead Ore:	
Salvador	692
Mexico	1,079,316
Chile	51,895
Peru	4,554
German Africa	1,747,200
	2,833,657
Lead—Base Bullion and Bullion:	
Canada	583,848
Mexico	848,662
	1,432,510
Lead—Pigs, Bars and Old:	
France	19,376
Panama	1,350
Barbados	1,000
Chile	8,769
Colombia	1,840
	32,335

The actual tonnage of zinc ore imported in February amounted to 16,177 tons. The countries of origin and the metal contents of shipments were as follows:

Zinc Ore:	
Canada	336,000
Australia	5,834,280
Mexico	7,249,914
	13,420,194
Zinc in Blocks, Pigs, etc.:	
Costa Rica	791
Panama	1,243
Cuba	30,286
Colombia	3,000
	35,320

Exports of zinc dust amounted to 52,800 lb.

Exports of lead and zinc were as follows (in pounds):

Lead pigs, bars, etc., produced from domestic ore	6,261,506
Lead pigs, bars, etc., produced from foreign ore	265,997
Zinc-spelter cast in pigs, etc., produced from domestic ore	30,610,767
Zinc-spelter cast in pigs, etc., produced from foreign ore	9,719,868
Zinc rolled in sheets, strips, etc	490,657

Goethals as Shipbuilder

President Wilson has written a letter to Major General Goethals requesting him to take charge of the plan devised by the Shipping Board to construct at once a fleet of 1000 wooden cargo boats to break the German submarine blockade. General Goethals has accepted.

Within a few days a bill will be presented to Congress authorizing the board to expend several hundred million dollars on the construction of these ships. The plan contemplates that the ships shall be standardized. They will be 250 ft. long and of 5500 tons' capacity. Upward of 40 large yards are prepared to turn them out.

Special Regulations No. 43, War Department, Mar. 29, 1917, gives in detail all the laws and regulations governing the Officers' Reserve Corps. Members of the corps and those who are contemplating joining should apply at once to the Adjutant General's Office, War Department, Washington, D. C., for a copy. Special appendices give (a) General Scope of Examination and (b) Textbooks Recommended.

Editorials

The $5,000,000,000 Loan

Congress has this week authorized the issuance of bonds by the United States Government to the huge amount of five thousand million dollars, two-fifths of which will be for our own purposes and three-fifths for the Allies in such ways as they may signify their needs. These bonds will not be issued all at once, but as required. Thus will financial conditions be least disturbed. They will bear interest at 3½%.

Subscription to the new loan is going to be a patriotic duty. It is also going to be the most gilt-edge investment for reserve funds. It must be shown, moreover, that the United States means business. In other words, the money must be promptly subscribed. Money talks.

Many of our mining companies have bulging treasuries. They have huge surpluses accumulated directly from conditions arising from the war. Many of them have already put their funds in Anglo-French and other foreign loans. Let them, and others, now subscribe liberally for the "Old Glory Loan." Do it quickly and do it lavishly. Not only will it be patriotic, but also will it look good in the balance sheets.

This editorial is addressed especially to the presidents and boards of directors, but none the less is the advice intended for the individuals of the mining industry—from the capitalist to the wage earner. To the humblest and most timid we say with confidence, Put your savings into Old Glory bonds.

Copper, Lead and Zinc

The markets for copper, lead and zinc since the declaration of war have been outwardly dominated by the uncertainty created in the first place by the offer by the copper producers to the Government of a relatively small quantity of copper at a greatly reduced price and the probability that the zinc and lead producers would do something similar. But we think that there are conditions more fundamental that are operating in these markets and are leading to the feelings of hesitation and the weakening tendency in copper and zinc.

Our readers will bear in mind that long ago we expressed the conviction that prices would come down, irrespective of continuance of the war, given time enough. Not that they would recede to former low levels, but rather to new ones corresponding somewhat to increased costs of production, which vary in the several cases. Merely as guesses, we think of the increased cost of producing copper on the average as being perhaps 10% above what it was just before the war; of lead, 30%; of zinc, 50%. Declining prices ought therefore to be checked for a longer or shorter period on such elevated frameworks, which later will be taken down gradually when the great readjustment begins—in other words, when the least economical producers begin to be forced out of business, releasing men and reducing the demand for supplies.

With respect to copper, we expressed the opinion last December that Great Britain and France had probably overbought their requirements for the first half of 1917 and that the producers had underestimated their output; and we looked therefore for an easing of the market at about this time. The first part of our opinion is undoubtedly proving correct, for it is well known that the producers are more or less behind in their deliveries to the Allies, whose sanction has been given to the dereliction. Our opinion as to production was mistaken, production having been curtailed by the strikes in several of the refineries and by the railway congestion, which caused certain of the refiners to have idle vats owing to inability to get raw material. Nevertheless it is certain that Great Britain and France have not got to buy copper for the second half of 1917 so early as three months ago was expected, and this is due to the great economies in the use of copper, as well as of other metals, that have been instituted abroad. And it is these conditions, we think, that are producing the present weakness in copper, not especially in the nearby position—which is still fairly strong owing to the scarcity of supply, but does not mean anything owing to the relatively trifling quantities either to be bought or sold—but rather in the major market; that is, for delivery in July and later, for which producers want to sell. They do not readily find buyers, and manifestly the price must go to a point where buyers will be interested.

Now that is not a gloomy prospect for the producers. It is better for them to sell copper freely at a profitable price than to have quotations of 30c. or upward and not sell any or, we should say, not very much. In fact, the weekly sales of copper have been light ever since the market culminated last November. Quotations have been made on relatively small transactions. Thirty-cent copper has looked fine on paper. But producers have not derived much profit from it. What they are doing is to deliver their output for the first half of 1917 on contracts that are yielding them 26½@27½c. In 1916 they earned big profits on averages of 24@26c. It was a rather insane idea that a new boom was going to start at about 30c. and go to what? 40c.? Even 30c was bound to curtail consumption.

We do not think that the offering of a little copper to the Government at 16¾c. had very much to do with the present situation except to inspire some soberer thoughts. Of still less concern are the ideas that Washington will commandeer large supplies of copper at that price. We think rather that both the United States and the Allies will buy their great supplies of copper at the market price—we do not see how there can be two prices, a government price and an industrial price—but the market price will probably be lower than now though still very profitable to the producers, for it will be necessary to maintain production at a high rate. The entry of the United States into the war will increase the demand.

As for spelter, the immediate situation is simple. Production is already in excess of demand at existing prices,

as everybody has been foreseeing it would be, and unsold stocks are accumulating. The mystery of this market is that it has held up so long as it has, the only explanation being that producers have held back their supplies expecting an improved demand and have been disappointed. When they came to that conclusion and tried to sell spelter, the price crumbled away. However, spelter has not, perhaps, very far to drop. During the depressions in 1916 declines halted at about 8c., which appeared to be bedrock under the then existing conditions, for some of the weaker smelters then began to go out of business. If the production of the strong concerns has sufficiently increased, another group of weak members may be put out on another decline which may find a new bedrock. Here again a new demand from the United States Government may be a retarding factor.

Of the three major metals lead is unquestionably the strongest. The explanation is again very simple; namely, demand is stronger than supply. A large demand from the Government would probably create a very interesting situation.

Let Us Avoid Economic Fallacies

The scheme for taxation submitted by Secretary McAdoo is in the main very sound, proposing as it does to levy on luxuries and avoiding any further increase in the inheritance tax. The proposal to reduce the limit of exemption from the income tax also is proper, but the increases on large incomes might well be tempered, anyway to begin with. Stamp taxes have among other advantages that of immediate collection. The collection of income taxes is necessarily belated, and pending their collection it is necessary to resort to other methods of finance. It should not be forgotten that it was not until September, 1915, when long continuance of the war seemed certain, that Great Britain began to emphasize the income tax, and it was not until the spring of 1916 that the existing high rate was fixed. Secretary McAdoo is fully justified, on the other hand, in his plan to increase the tax on alcoholic spirit and beer, while those who suggest the excessive taxation of those things are either insincere or incorrect. If it be their idea to effect national prohibition by making drink too costly for use, that is one thing; but it would not be a revenue measure at all, for if there were no use, there would be no taxes collected.

A common fallacy is the idea of conducting a cheap war; that is, a war in which nobody is to be permitted to make any profit in supplying the army and navy. There is no such thing as a cheap war. War by its nature is costly. Economy in the purchase of supplies and in administration is desirable, but paramount is efficiency. There has been so much irresponsible clamor about the war being forced by munition makers for their own profit that there seemed to be great danger that the executive departments would be led into grave errors in the zeal to prevent extortion. This spirit is highly commendable when directed against unpatriotic persons who seek to palm off embalmed beef, useless steam yachts, etc., on the Government at high prices and do such things as created scandals in the Civil War and during our recent little war with Spain. But if cheese-paring is to be practiced at the expense of speed in securing necessary equipment, it is not economy at all, but rather a drag upon efficiency. Economy *and* efficiency should be the watchwords, and business men should be credited with the patriotism that everyone feels.

Closely connected with this is the matter of price regulation, not only of military material, but also of foodstuffs and all the things required by the workers behind the lines. The talk of price regulation has displayed an amazing ignorance of economics. High prices contain the elements of their own cure. They are necessary in order to speed up production. That is the reason why they beome high. When production is sufficiently stimulated, they begin to fall. European experiences have illustrated the cycle. On the first great upward rush of prices the governments have sought to check and control the movement by fixing maxima. The result has been just the opposite of what was hoped. If things had been let alone, the high prices themselves would have restricted consumption and the recession would have ensued. The establishment of moderate maxima simply stimulated consumption. So the governments had to make the sound economic move of controlling consumption. Then it appeared that low prices discourage production, which has to be maintained by fixing minima, or guaranteed prices. The very governments that started out with fixing maxima have ended with fixing minima.

There may be properly, of course, such governmental regulations as will prevent speculative "profiteering," but the true control of prices lies in control of consumption. Do that and the matter of prices will take care of itself. The great essentials with regard to all commodities is first to reduce wastes; next to restrict unnecessary uses. The British and French have learned this. We Americans are also going to learn it. That we are going to be forced to do so makes us more hopeful of the future than we should have been if the war had ceased six months ago, when we were at the height of our extravagance.

What of Business Prospects?

Since the United States has entered the war, business has halted owing to fears of oppressive taxation. Previously, there had been ideas of activity resulting from the inflation that always follows the financial measures necessary to carry on war. Such ideas were chilled, however, by the talk of carrying on the war cheaply, and what with the intimations about conscripting industries and so levying taxes as to pay as we go, there has been a pall of gloom thrown over business. Probably we have swung too far into pessimism, as previously we had done into optimism.

Now, no economist will pretend that war is ever inherently a benefit. If it were, we should be at war all the time. War may be a benefit for the correction of evil, just as is a surgical operation, but nobody submits himself to the latter unless he is obliged to, and either a war or a surgical operation is a costly thing which would be avoided unless something worse were likely to result. But in the case of war it has been the common experience that during the progress of it there has been great industrial activity and apparent prosperity.

As to what is going to happen to business in the United States in the immediate future, it is likely that out of the confusion of the moment some fundamental conditions will emerge. Common sense will prevail, as generally it does. This means that industries will not be so

unduly throttled by taxation that they cannot be carried on, for if that were to happen, we could not carry on the war itself. The expenditure of large sums of borrowed money is bound to produce activity. There is no reason to foresee that we are going to reverse the experiences of the past. On the contrary, there is every reason to expect that business in the United States at war will follow the course of business in Great Britain at war, which has been active, as everyone knows. Inasmuch as our method of financing will probably be planned according to British precedents, it is likely that our industrial experiences will be similar. We are not to expect a boom, however, for our prices were already at a high—too high—level and readjustment downward was impending anyhow; but we may expect a continuance of activity and a high level of prices.

Tin Plate and Can Industry

This industry is seriously handicapped by the difficulty of obtaining an adequate supply of pig tin, which has to be imported from the Straits Settlements, Australia, China and Java. In consequence of these difficulties, American manufacturers are forced to pay for pig tin 55c. per lb., while English manufacturers are paying about 46c. per lb. Besides consumers of tin cans have been unable in many cases to obtain a sufficient supply for their needs. The packing and canning industries are being seriously affected, while in other lines like tobacco, etc., substitutes for tin cans are being considered. Prompt relief is necessary before this year's crops are available.

We printed an edition of 14,000 copies of our Special Mining Number, but this was exhausted within a few days after publication. We regret, therefore, that at present we are unable to supply the demand for additional copies that still continues. There are probably some of our readers interested in metallurgy rather than mining who do not care to preserve the issue of Apr. 7. We shall be pleased if they will return to us copies that are not needed. We will pay the postage and the regular price of 15 cents per copy.

Total subscriptions to Belgian Kiddies up to date amount to $86,812. This is not increasing as rapidly as it should. Get busy!

BY THE WAY

Under the caption "Class Legislation," the Boston *News Bureau* says: "Representative Cary, Wisconsin, introduced resolution that in raising army by selective conscription, first selection should be made from such male citizens of proper military age as are officers or members of New York Stock Exchange or any other similar body or officials in banks, lawyers, magazine editors and other citizens engaged in nonproductive pursuits." Our idea of zero in legislative, productive and military qualifications is typified by the honorable members from Wisconsin.

Selling to the Government at "10% over cost" sounds simple until one asks what "cost" is, remarks the New York *Evening Post*. The direct costs are of course ascertainable, but in most factories more than half the cost is overhead and this varies with the total quantity turned out. How shall it be distributed? There are also the questions of rent, heat, office and selling expenses in a factory turning out a variety of articles which pass through a series of processes. These are matters of disagreement among experts. How much rent should be permitted to a factory owned by the managers? How large salaries should go to the officers? How shall we estimate repairs and improvements? By a series of arbitrary decisions the Interstate Commerce Commission has forced a uniform cost system on the railroads. Factories have none, and it is hard to see how they can have any. It may be better to leave economic forces to work themselves out, and regulate profits by taxation. To any one who has followed English experience in tampering with industrial machinery the danger will be obvious.

Speaking of Hoover's new job, the New York *Evening Post* said: Everyone who knows Mr. Hoover or anything about his work will acclaim the invitation to him by our Government to take special charge of matters relating to food supply and food distribution in this country. Mr. Hoover has made proof of his genius for organization on a grand scale. While his heart must still be given to the vast work of Belgian relief, it may be that the machine which he built for it is now running so efficiently that he can take his hand from it. Certainly, at home he could find scope for his exceptional powers. The lack of coördination in our whole system of producer-to-consumer has long been notorious; and if anybody can introduce method and economy into it, Mr. Hoover is the man, especially if he is clothed with peculiar authority in time of war. To ask him to take the laborious position is at once a recognition of his great achievement and a way of doing marked honor to him. For Mr. Hoover is one to value, above praise for work done, the opportunity to do new work.

The super-refined quintessence of editorial courtesy is exemplified in the following from our esteemed contemporary *Power*. It is said that the return of a manuscript to its author may imperil the life of the Chinese editor and that only by the invariable use of the most gracious, courteous and apologetic language can he expect to avert the awful wrath of the contributor whose manuscript is declined, and save his own editorial head from swift decapitation. The following letter from a Celestial editor, accompanying the return of a manuscript, surely denotes tactfulness and a realization of the direful consequences if the recipient took offense thereat, says *Our Dumb Animals*: Most honored brother of the sun and the moon: Your slave is prostrate at your feet! I kiss the ground before you, and implore you to authorize me to speak and live. Your manuscript has permitted itself to be looked upon by us, and we have read it with enchantment. I swear on the tomb of my ancestors that I have never read anything more exalted. It is with fear and terror that I send it back. If I allowed myself to print this treasure, the president would immediately order me to use it forever as an example, and forbid me to dare to print anything inferior. My literary experience enables me to declare that such literary pearls are only created once in ten thousand years, and this is why I take the liberty of returning it to you.

New Publications

Oil Investigations in Illinois in 1916. Directed by Fred H. Kay. Pp. 80; illus. Bull. 35, Illinois State Geological Survey, Urbana.

Cost Accounting: Theory and Practice. By J. Lee Nicholson. 5½ x 8½, pp. 341, illus.; $4. Ronald Press Co., 20 Vesey St., New York, 1916.

Cobalt Alloys with Noncorrosive Properties. By Herbert T. Kalmus and K. B. Blake. Pp. 37; illus. Part IV. Canada Department of Mines, Ottawa.

A Study of the Magmatic Sulphide Ores. By C. F. Tolman, Jr., and Austin F. Rogers. 6½ x 10, pp. 76 and 20 plates. Stanford University, Calif.

The Transactions of the Canadian Mining Institute, 1916. Edited by the Secretary, H. Mortimer-Lamb. 5½ x 8¾; pp. 429; illus., Vol. XIX. Canadian Mining Institute, Montreal.

The Theory of Drying and Its Application to the New Humidity-Regulated and Recirculating Dry Kiln. By Harry D. Tiemann. Pp. 28, illus. Bull. 509, U. S. Department of Agriculture, Washington.

The Geology of the Country to the South of Kalgoorlie, Including the Mining Centers of Golden Ridge and Feysville. By C. Sidney Honman. Pp. 75; illus. Bull. 66, Western Australia Geological Survey, Perth.

Handbook of the Mining Industry of Oregon. Alphabetical List of Mines, Mining Companies and Prospects; Description of Mining Districts. By H. M. Parks and A. M. Swartley. Pp. 306, illus. Oregon Bureau of Mines and Geology, Corvallis.

Pipe and Public Welfare. By R. C. McWane. 5 x 7½, pp. 165, illus.; $1. The Stirling Press, New York.

Four chapters dealing with the early history of pipe installations, process of manufacture of iron pipe, its deterioration and development of wood pipe. Interesting reading for those interested in pipe manufacture.

The Efficient Purchase and Utilization of Mine Supplies. By Hubert N. Stronck and John R. Billyard. 5 x 7½, pp. 97, illus.; $1.25. John Wiley & Sons, Inc., New York.

A little book but interesting, describing a very complete system of purchase and store methods and accounts for mines of considerable size; but containing many suggestions and blanks which could well be adopted by small mines with small clerical forces.

Boletin de Minas, No. 2, Jan., 1917. Pp. 103, illus. Secretaria de Agricultura, Comercio y Trabajo, Habana, Cuba.

The report of the geological reconnaissance in 1901 by C. Willard Hayes, T. Wayland Vaughan and Arthur C. Spencer, for Major General Leonard Wood, translated into Spanish, with notes on the mines of Puerto Principe, Cobre, Manicaragua. Also a short article on the influence of climate on the formation of minerals.

Part of the District of Lake St. John, Quebec. By John A. Dresser. Pp. 88; illus. Memoir 92, Canada Department of Mines, Geological Survey Branch, Ottawa.

A geological description of this region, 120 miles north of Quebec City. An interesting chapter on the possibility of electric smelting of the iron ores of the St. Charles deposit, with estimated costs compared with smelting.

Water Powers of Manitoba, Saskatchewan and Alberta. By Leo G. Denis and J. B. Challies. 7 x 10, pp. 334, illus. Commission of Conservation, Ottawa.

The results of further work since the publication of "Water Powers of Canada" in 1911. Rainfall data, profiles of the principal rivers and an appendix containing a table of the available water power capable of development makes this book most useful for an engineer contemplating hydraulic or hydro-electric development in the provinces covered.

Engineering Analysis of a Mining Share. By J. C. Pickering. 6 x 9, pp. 95; $1.50. McGraw-Hill Book Co., New York.

This estimable little book is a readable and highly interesting discussion of the many factors that an engineer weighs when examining and considering a mining proposition, and it is made human (which the majority of such attempts are not) by the author's appreciation of the non-technical training of his reader, for which class it is intended, and by his choice of popular and well-known mining shares to be analyzed for examples.

Royal Ontario Nickel Commission Report. Pp. 528; illus. Royal Ontario Nickel Commission, Toronto.

Contents: Summary and Conclusions; Agitation for Home Refining of Nickel; Historical Sketch of Nickel Discoveries; The Operating Nickel Companies; Nickel Deposits of the World; Properties and Uses of Nickel and Its Compounds; Nonferrous Nickel Alloys; Nickel Steel and Other Nickel Alloys Containing Iron; Smelting Nickel Ores; Refining Processes; Recovery of Metals of the Platinum Group; Recovery and Utilization of Sulphur; Statistics; Taxation of Mines and Mining Industries.

Illinois State Geological Survey, Year Book for 1915. Administrative Report and Economic and Geological Papers. 6½ x 10, pp. 180; illus. Bull. 33, Illinois State Geological Survey, Urbana.

Administrative Report, by F. W. DeWolf; Mineral Resources of Illinois in 1915, by H. J. Skewes; Petroleum in Illinois in 1914 and 1915, by Fred H. Kay; Geological Structure of Canton and Avon Quadrangles, by T. E. Savage; Notes on Bremem Anticline, Randolph County, by Fred H. Kay; Oil and Gas in the Birds Quadrangle, by John L. Rich; and Oil and Gas in the Vincennes Quadrangle, by John L. Rich.

The Journal of the Iron and Steel Institute. Edited by George C. Lloyd. 5¼ x 8¼, pp. 503, illus. Vol. XCIV. Iron and Steel Institute, London, S. W.

Contains a list of council and officers, minutes and proceedings of the meetings, and the usual collection of papers and discussion thereon, together with notes on the progress of the home and foreign iron and steel industry, covering iron ores, their composition and appearance, iron-ore mining, mechanical separation; refractory materials; fuel; production of iron; foundry practice; and the production of steel; forging and rolling-mill practice; further treatment of iron and steel, physical and chemical properties, chemical analysis and economics.

A Handbook of Briquetting. Vol. 1, The Briquetting of Coals, Brown Coals and Other Fuels. By G. Franke, translated by Fred. C. A. H. Lantsberry. 6 x 8½, pp. 631, illus. London, Charles Griffin & Co.; Philadelphia, J. B. Lippincott Co.

This volume, by the professor of mining, ore dressing and briquetting, in the Kgl. Bergakademie in Berlin, and translated by Lantsberry, the head of the Birmingham Small Arms Co. Laboratory, deals wholly with the briquetting of pit coals and brown coals, including the preparation of wet compressed blocks. A second and shorter volume will follow soon and will describe the briquetting of ores, metallurgical products, metal swarf and agglomeration.

The Mining Manual and Mining Year Book for 1917. By Walter R. Skinner. 5 x 8½ in.; pp. 960. 17s. Walter R. Skinner, London, E. C., England.

The 1917 volume of this well-known mining year book, which is the thirty-first consecutive yearly issue, has appeared this year with its usual regularity, and is especially welcome at this time when reliable information regarding the various mines, their financial position, etc., is so useful. It is a matter of congratulation that the war has not interfered with the publication of this work. Each volume has either kept up to the standard of the preceding one, or has shown an improvement. No important innovations are noted in the present volume, but all of the good features are continued.

State Oil and Gas Supervisor of California for the Year 1915-16. Covering Operations of the Department of Petroleum and Gas of the State Mining Bureau. Submitted by R. P. McLaughlin. Pp. 278, illus. Bull. 73, California State Mining Bureau, Sacramento.

The first annual report of the State Oil and Gas Supervisor, relative to the work of protecting the oil fields from damage by infiltration. The report is worthy of special comment, because the law authorizing the work is an entirely original development from California experience, and not previously used in any other state. As a result of a year's operation, it has been found that this pioneer legislation not only has been effective, but meets with the approval of most of the oil operators, and only minor details need revision.

Elements of Mineralogy, Crystallography and Blowpipe Analysis From a Practical Standpoint. By Alfred J. Moses and Charles Lathrop Parsons. 5¼ x 8¾, pp. 631, illus.; $3. Fifth Edition, enlarged and in part rewritten. D. Van Nostrand Co., New York.

This work includes a description of all common and useful minerals, their formation and occurrence, tests necessary for their identification, the recognition and measurement of their crystals, and their economic importance and uses in the arts. About 200 additional pages have been included in this latest edition, the section on crystallo-optics has been enlarged, together with schemes for crushed fragments and group optical distinctions consequent upon the proved value for polarizing microscopes. One chapter gives a summary of useful tests with the blowpipe, and the work concludes with extensive and valuable tables for rapid determination of the common minerals. Alfred J. Moses is professor of mineralogy at Columbia University, and Charles Lathrop Parsons is chief chemist of the United States Bureau of Mines.

Workmen's Compensation Laws of the United States and Foreign Countries. Pp. 961. Bull. 203, U. S. Bureau of Labor Statistics, Washington.

Contains reports of the commissions of various states, progress of legislation and comparison of principal features of the various laws and their many ramifications. A chart showing the principal features of the various laws is given and an analysis of the principal features of the laws of the various states. The constitutionality and construction of statutes, due process of law, jury trial, liability without fault, abrogation of employers' defenses, are some of the many details discussed. Under the head of "Workingmen's Compensation Laws of Foreign Countries" are given the details of progress of such legislation, industries covered, persons insured, character of benefits, disabilities not compensated, disabilities compensated, burden of cost, procedure, organization of the insurance, security of payment, and an analysis of the principal features of such laws in Canada, Europe, Russia and Australasia.

The "South American Year Book" will be edited and published in the United States by the Americas Publishing and Printing Corporation, 20 Vesey St., New York. Heretofore this work has been published by the Louis Cassier Co., Ltd., of London. It is the intention of the new owners to increase the value of the Year Book for the people of this country by editing it from an American standpoint. In furtherance of this idea, special attention will be given to information helpful to the extension of American commercial and financial interests in South America. The 1917 edition, which will appear in September, will contain the latest obtainable information pertaining to the industrial, commercial, agricultural, financial, and political development of every South American country, as well as historical and geographical data. Latest reports of South American railroads, industrial, and public utility companies, and especially those whose securities have a market in this country, will be given. There is to be published with the book a complete map of South America, 30 x 40 in., in full color, compiled by Alexander Gross, F. R. G. S., from accurate Government data.

English and Engineering. A Volume of Essays for English Classes in Engineering Schools. Edited by Frank Aydelotte. 5 x 7, pp. 390. $1.50. McGraw-Hill Book Co., New York.

Whether the study of English is universally detested by students because its appreciation only comes to mature minds or because it is usually the worst example of our execrable system of education in general does not seem to be a doubt after reading this book, which is a collection of isolated essays by the peers of English literature. John Ruskin on "Writing and Thinking," and George Henry Lewes on "The Principles of Sincerity," show in an intensely and entirely undidactic way that it is hopeless to write about something not previously thought out and useless to write if you do not have a heartfelt interest in what you write. With both of these "The Question of Style," by Arnold Bennett is no longer a bugaboo and something acquired only by tremendous effort, but a something as indefinable and as naturally characteristic as wearing one's clothes or one's gait or tricks of the features. Huxley, Tyndall, Mathew Arnold, Emerson, Robert Louis Stevenson, have all been drawn on for gems of one kind and another, and this book is such a pleasure that you feel peevish at your old English "Prof" for what he did not make you see when up against the old grind. However, this book was edited and compiled by the professor of English at M. I. T., so maybe it is not professor's faults, but our own after all.

Notes on Military Explosives. By Erasmus M. Weaver. 5½ x 9, pp. 382, illus. $3.25. Fourth edition, revised and enlarged. John Wiley & Sons, Inc., New York.

The fourth edition, revised and enlarged, of this book, by Major-General Erasmus M. Weaver, U. S. Army, and Chief of the Coast Artillery, is particularly opportune at this time. It has long been the standard work on military explosives, and has been used continually as a textboox at the United States Military Academy at West Point. This edition has been brought up to date and includes certain changes that have developed in connection with the European War, particularly the substitution of wood pulp for cotton in the manufacture of nitro-cellulose explosives and the fixation of nitrogen of the air by the three separate processes which are now employed. No new explosives of importance have been discovered and introduced since the last edition of this book appeared, the field of military explosives apparently being definitely limited to the nitro-cellulose series, the nitro-glycerine series, the nitro-benzine series, the alkaline metallic nitrate mixtures, and to a combination of some of these with each other. The great propellent explosive for guns continues to be nitro-cellulose; the explosive for charging shells, picric acid or some derivative thereof; and for submarine mines and torpedoes, either trinitrotoluol or gun-cotton; and to the old nitrate mixtures for use in hand grenades, rockets, and pyrotechnics. The principles of chemistry applying to explosives are given in detail, and the substances used in the manufacture of explosives are described at length. General remarks on explosives cover also progressive and detonating explosives and their differences, fundamental and practical, are followed by chapters on service tests of explosives, and instructions for the proper storage handling. A chapter is devoted to military demolition, showing the proper way to destroy buildings, bridges, iron plate, masonry tunnels, stockades, railroads, etc.

Personals

A. Livingstone Oke is a major in the Royal Garrison Artillery.

L. D. Huntoon has left New York for a professional trip to Wisconsin.

Dyke V. Keedy has been in Paramaribo, Dutch Guiana, making some mine examinations.

George A. Laird, recently returned from Australia, is spending a few weeks in New York.

John Eadie has been appointed general manager of the Wallace Shipyards, North Vancouver, B. C

Lieut. O. H. Woodward, of Australia, has received the Military Cross and promotion for distinguished service at the front.

F. P. Sinn has been made general superintendent at Palmerton, Penn., for the New Jersey Zinc Co., succeeding J. A. Singmaster.

H. J. Rahilly, a mining engineer of the Bureau of Mines, has resigned to accept a position with the Anaconda Copper Mining Co.

Oscar Lachmund, manager of the British Columbia Copper Co., is in New York consulting with the directors of that company.

Rush M. Hess has resigned the superintendency of the Stoddard Mines Co., of Arizona, and expects to be in New York in the near future.

George T. Holloway, of London, has completed his work as chairman of the Ontario Nickel Commission and will shortly return to England.

Harlan A. Depew, a physical chemist in the service of the Bureau of Mines at Pittsburgh, is to be transferred to the Seattle Experiment station.

J. Morgan Clements sailed on Wednesday, Apr. 18, to begin his investigations of mineral resources abroad, as has been already noted in the "Journal."

Francis S. Schimerka, who has been in charge of leaching operations at the Shannon Copper Co., Clifton, Ariz., for the last four years, has resigned his position.

F. C. Ryan, of the Seattle station of the Bureau of Mines, has been instructed to make an examination of the electrical metallurgical plants of the Northwest.

Major Peter N. Nissen, Royal Engineers, inventor of the Nissen hut and well known to American and Canadian engineers, has been awarded the D. S. O.

J. A. Singmaster, formerly general superintendent for the New Jersey Zinc Co., at Palmerton, Penn., has been transferred to the New York office in charge of metallurgical investigations.

Frank H. Sistermans, of 60 Broadway, has gone to New Mexico in the interest of Eastern clients and will be absent for several months, during which time his address will be Lake Valley, c/o Roper Group Mining Co.

C. E. Bunker has been appointed superintendent of the Bunker Hill mine, at Amador, to succeed E. Hampton, recently resigned. Mr. Bunker was formerly employed at the Keystone Mines, at Sutter Creek.

J. B. Johnson, for the past seven years in the employ of the Anaconda Copper Mining Co. as construction engineer at the Washoe smeltery, has resigned and left for Clifton, Ariz., to be chief engineer for the Arizona Copper Co.

George W. Short, vice-president of the Sharon Steel Hoop Co., Sharon, Penn., and general manager in charge of the works in that city, has been made vice-president and will have charge of all the company's plants in the Shenango and Mahoning Valleys.

L. P. Alford is now identified with "Industrial Management," formerly "Engineering Magazine," as editor in chief. He was editor of the "American Machinist" for about 10 years. "Industrial Management" is shortly to move its offices and will be located at 6 East Thirty-ninth Street, New York.

Chen Cho, mine commissioner for the Province of Yunnan, China, is in the United States to study mining methods and select some American machinery for Yunnan mining operations. He is as present in New York, at the Park Avenue Hotel, but will soon start on a trip to the principal mining centers.

Obituary

George Evans, a miner at the Neversweat mine of the Anaconda Copper Mining Co. at Butte, Mont., while working on the 1400-ft. level of that mine, was killed on Apr. 10 by a huge slab of rock falling on his head, throwing him between the rails of the track into a chute underneath.

Lieut. James M'Bryde, of the First Field Company of Engineers, A. F. K., was killed in the battle of the Somme, Sept. 13. He was a graduate of Sydney University, Australia. Prior to enlisting in the early stages of the war he was on the staff of the Cocks Pioneer Mine, Eldorado, Victoria. He served with distinction at Gallipoli, Egypt and France, taking part in the battle of Pozieres.

Harry C. Cutler, a well-known mining engineer of Reno, Nev., died at Reno on Apr. 6. Cutler was one of the first mining engineers to enter the Goldfield district and was an engineer for the Wingfield interests in Goldfield during the earlier days of the camp. Of late he had been associated with Walter Trent of the Trent Engineering Co., of Reno, in the operation of the Como properties at Como, near Dayton, Nevada.

John J. Drummond, of Midland, Ont., a pioneer in the iron-industry of Canada died in Montreal on April 7, in his 61st year. He had been failing to health for some time and had gone to Montreal for medical treatment. He was one of four brothers, all of them prominent men, one of whom was the late Dr. Wm. H. Drummond, the noted author. He was born in Ireland and went to Canada when quite young. After serving his apprenticeship as machinist and engineer he went to Sweden, where he studied the construction and operation of blast furnaces, and also visited from time to time the principal iron centers of Europe and the United States. Mr. Drummond was one of the first designers and operators of blast furnaces in Canada in connection with the Drummond plants in St. Maurice Valley and at Radnor Forges, Que., in Nova Scotia and later at Midland, Ont., where he was President of the Zenith Machine Co., Ltd. He was very popular with his employees and during 30 years of business life never had any labor troubles. He is survived by a widow, one daughter and three sons, two of whom are overseas with the Canadian forces.

Societies

American Institute of Chemical Engineers will hold its ninth semiannual meeting at Buffalo, N. Y., June 20 to 22.

New York University, School of Commerce, Accounts and Finance, has issued a preliminary announcement of its day and evening sessions for 1917 and 1918. The school purposes to give thorough and practical training for business life.

Institute of Metals, London, has issued its list of members and officers, together with a list of the technical papers presented during 1916 at its various meetings. The address of the Institute's offices has been changed to 36 Victoria St., Westminster, S. W. G. Shaw Scott is secretary.

University of Washington, College of Mines, is making its annual spring excursion to the Cœur d'Alene region of Northern Idaho. A party of 15 students and instructors is visiting the Bunker Hill Sullivan mine, mill and smeltery, at Kellogg and several other plants in the vicinity of Wallace and Mullan.

University of Wisconsin has presented its preliminary announcement of the summer session of 1917. Courses are offered in the academic grades and are planned to meet the needs of graduate and undergraduate students of colleges, technical schools and universities. The bulletin, No. 837, General Series 632, provides a general description of all of the work and shows the terms of admission, fees, etc.

Colorado Scientific Society meeting of Apr. 7 was addressed by Prof. George J. Young, of the School of Mines, on "The Kern Country," this being a paper descriptive of a California area in the forest reserve of the Sierra Nevadas just east of the Sequoia National Park. Teknik Club held its regular April meeting the night of the 10th, this being also the annual "ladies night." Hugh B. Lowden, of the Colorado Iron Works, delivered an illustrated address on "Diatoms."

American Electrochemical Society, New York section. At a joint meeting at the Chemists' Club on Friday, Apr. 13, with the New York Sections of the Society of Chemical Industry and the American Chemical Society, the following officers were elected for the ensuing year: Chairman, J. V. N. Dorr, president of the Dorr Co.; vice-chairman, E. D. Kingsley, of the Niagara Alkali Co.; and secretary-treasurer, J. Malcolm Muir, business manager of "Metallurgical and Chemical Engineering."

American Institute of Mining Engineers, St. Louis Section—The members of the Institute living in the lower Mississippi Valley extend a cordial invitation to their fellow members to meet with them next October, in St. Louis. They believe that it will be a meeting of singular interest inasmuch as the district in question can show in active production almost all of the more useful metals and nonmetals. The Southeast Missouri district, to which a special trip is planned, is the largest lead district in the world. It was that before the European war; and now that the production of lead has greatly decreased abroad, and has correspondingly increased in the United States, this is one of the most interesting of all lead districts. The ore is smelted at the various plants of the different companies, located at Herculaneum, Alton and Collinsville, with a combined capacity of 250,000 tons of lead per annum. These smelteries will be visited on the occasion of the meeting.

Industrial News

Sullivan Machinery Co. has removed its Canadian office from Montreal to 37 Colborne St., Toronto, Ont.

Industrial Laboratories Co., Hammond, Ind., is building a laboratory that will be the most completely equipped custom testing plant in the Calumet manufacturing district.

MacCamy Air Cooler & Condenser Co., is now building a condensing intercooler for a 6000-cu.ft. compressor for the Cananea Copper Co., Cananea, Mex., and also one for an 800-cu.ft. compressor for the Yak Mining Co., Leadville, Colo.

Ingersoll-Rand Co., in its statement for 1916, showed a handsome increase in net earnings. The surplus was $7,104,098, equal to $65.17 per share on $10,900,035 common stock, against $53.55 on $8,469,400 common stock in the previous year.

Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, built a 1500-ton hydraulic forming press for use in Japan, to make asbestos shingles. A feature of the press is a track running between the columns to carry on a truck the material to be pressed. The wheels of the truck, it is stated, are free from all strain during the pressing operation.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has received contracts totaling about $2,000,000 from the New York Shipbuilding Co. for electrical equipment for the propulsion of the new battleships "Colorado" and "Washington." The equipment is like that arranged for the "Tennessee" now building at the New York Navy Yard.

E. J. Lavino & Co., Philadelphia, who acquired, some weeks ago, the Vesta blast furnace at Watts, Penn., has torn down the shell and will put up a new shell and provide filling equipment. The company also acquired Aurora furnace at Wrightsville, Penn., which has been dismantled, its stoves being moved to the Vesta furnace. Both furnaces were formerly the property of the Susquehanna Iron Co.

New Patents

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum-Soldering Compound. Charles A. Stewart, Carson City, Nev. (U. S. No. 1,222,158; Apr. 10, 1917.)

Briquetting Machine. John F. Lovejoy, New Rochelle, N. Y., assignor of one-half to Abe Stein, New York, N. Y. (U. S. No. 1,221,878; Apr. 10, 1917.)

Cableway. Charles McGuire, Seattle, Wash. (U. S. No. 1,222,007; Apr. 10, 1917.)

Crushing—Grinding Mill. David Cole, Tucson, Ariz. (U. S. No. 1,222,184; Apr. 10, 1917.)

Desulphurizing Ores, Process of. Howard F. Wierum, Upper Montclair, N. J., assignor to the Sulphur Syndicate, Ltd., London, England. (U. S. No. 1,222,252; Apr. 10, 1917.)

Drying—Method of and Apparatus for Drying Materials. George B. Damon Belvidere, N. J., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,222,079; Apr. 10, 1917.)

Ferro Alloys—Process of Producing Alloys. Isador Ladoff, Wilkinsburg, Penn., assignor of thirty one-hundredths to Walter D. Edmonds, Boonville, N. Y. (U. S. Nos. 1,221,873 and 1,221,874; Apr. 10, 1917.)

Fuel—Firing Chamber for Powdered Fuel. Walter D Wood, Allentown, Penn., assignor to Fuel Saving Co., Allentown, Penn. (U. S. No. 1,222,344; Apr. 10, 1917.)

Mining System. George Griffin Hughes and John Flack McDuffie. Bessemer, Ala. (U. S. No. 1,221,860; Apr. 10, 1917.)

Ore Separator. Allonzo O. Thomas, Rollinsville, Colo. (U. S. No. 1,222,491; Apr. 10, 1917.)

Percussive Tools, Valve for. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,222,353; Apr. 10, 1917.)

Phosphate—Process for Producing Citrate Soluble Phosphates. Jacob G. Lipman, New Brunswick, N. J. (U. S. No. 1,222,112; Apr. 10, 1917.)

Roasting Furnace. William W. Whitton, Oakland, Calif. (U. S. No. 1,222,251; Apr. 10, 1917.)

Sintering—Process for Sintering Fine Oxide Ore and Metallurgical Products. Heinrich Bittmann, Frankfort-on-the-Main, Germany, assignor to Dwight & Lloyd Sintering Co., Inc., New York, N. Y. (U. S. No. 1,221,962; Apr. 10, 1917.)

Ventilating System for Tunnels and the Like. Denton K. Swartwout, Cleveland, Ohio, assignor to the Ohio Blower Co., Cleveland, Ohio. (U. S. No 1,222,569; Apr. 10, 1917.)

Editorial Correspondence

SAN FRANCISCO—APR. 11

Chromite Mining is a comparatively new industry in northern California and southern Oregon. Until the European War, no ore was shipped from this region. This season every ton that is available will find a ready market, buyers having been scouring the district all winter. American manufacturers, shut off from the old sources of supply by the war, must turn to deposits in southern Oregon, northern California, the Dakotas and Canada for their supply, and practically every person or corporation controling chromite deposits in this district is preparing for an active season.

Transport in Inyo County continues to be a matter of much moment to the mining operators, who are watching closely the developments in this situation. Geographically Inyo County belongs in the southern half of California but the interest displayed by Los Angeles in its development has not been so great as that of San Francisco. Industrially the region, which lies east of the Sierra Nevada and north of San Bernardino County, is closely allied to Nevada. A large amount of money used in the development of Inyo County mines is supplied by Nevada men, and much of the ore mined goes through Nevada to Salt Lake and to Oklahoma for treatment. But San Francisco also plays a large part in the development and operation of the mines of this region and furnishes a large proportion of the machinery and supplies; and there is no question as to the attitude San Francisco would assume if transportation facilities between this city and Inyo County points were as favorable as between those points and Los Angeles. The Los Angeles "Times" is inclined to treat the subject of Inyo County's position with a crude effort at humor, which if considered seriously would make Inyo appear ridiculous. There was nothing humorous, however, in the situation 40 years ago when the freighting by teams of the ores of this region to Los Angeles and the purchase of supplies and machinery in that city provided the means that aided largely in keeping Los Angeles on the map until the tourist arrived.

"War Minerals" in California will receive particular attention of the State Mining Bureau field assistants in a new survey just started under direction of Fletcher Hamilton, state mineralogist. These minerals are chrome, coal, iron, magnesite, manganese, molybdenum, quicksilver and tungsten. Petroleum resources and availability have already been so thoroughly and recently investigated by the bureau that the present field work will not include this important material. However, the survey will not be solely confined to the special minerals but will include the common metals and minerals as well. For the last four years, the bureau has been working on a complete survey of the mineral resources of the state by counties. The field work in all the counties has been practically finished and the reports of several counties have been published. This work will be continued in the present campaign; but particular attention will be given to obtaining the latest data regarding the resources, development and availability of the special minerals. W. Burling Tucker, chief field assistant, will visit the counties south of the Tehachapi. Walter W. Bradley, mining statistician, will visit Siskiyou and Shasta Counties and continue the research already in hand in the metallurgy of cinnabar ores and bring the data regarding the resources of quicksilver to date. The other field assistants are assigned as follows: Clarence A. Waring, to the counties along the Sierra Nevada from Tulare north; Emile Hugenin, to the counties along the Coast Range from Monterey north to Del Norte. The survey will cover the situation, area, accessibility to transportation, character, quality, development, etc., of every known deposit in the state, and the reports added to those already published will form the most complete and comprehensive contribution to this class of literature the State Mining Bureau has ever published.

Blue Ledge Copper District in northern Siskiyou County, but most accessible from Medford, Ore., has been growing more active during the last two seasons and these activities have been notably stimulated during the last 10 days by friendly weather conditions. The fourth carload of rich copper-gold ore was shipped this week from the Blue Ledge mine, 35 miles distant from Medford, to the smeltery at Tacoma, Washington. The mine is now being equipped with compressors and other machinery to expedite the work of mining and men are being added to the force as rapidly as they can be obtained. The ore is hauled by team 30 miles to the railroad. New plans are under discussion for the construction of a railroad to the Blue Ledge district from Medford during the coming summer, the enterprise as now proposed being independent of any of the mining companies operating or preparing to operate in that district. A rate of $2 a ton is figured for the 30-mile haul, and the estimated cost of the line is $400,000. This road would encourage the immediate operation of the Bloomfield, the Copper King, the Cook & Green and other promising properties in that district. The Iron Hand, a copper property in Squaw Creek district, 30 miles from Medford, and a feeder of the proposed Blue Ledge railroad, was bonded a few days ago to Nevada miners for $15,000, immediate operation being one of the conditions of the lease. Its sister group, the Iron Knob, is under negotiations by Messrs. Spencer & Spiker, with Salt Lake men on a $20,000 bond. An interest to the Sylvanite group of gold quartz claims, comprising 242 acres, was sold last week to J. G. Davies and others, of Sacramento, Calif. G. B. Stone and others purchased this property last year and operated some of the claims with marked success. Mine investors are coming in from many parts of the country and several mining engineers are investigating properties in the southern Oregon districts at this time.

DENVER—APR. 11

Tungsten is Not a Dead Issue in Colorado. Although the rush in Boulder County has become history, mining of this metal continues actively. Upon a 60% basis, crude ore sells at $15 per unit and concentrate at $17. Ore running 25% WO_3 sells for $9.40 to $12 per unit, while 10% ore brings between $8.70 and $10. Mills that purchase ores and produce concentrates are running full capacity. Construction of the second plant in the city of Boulder for the production of tungstic acid, metallic tungsten and ferro-tungsten proceeds rapidly.

Wages Are Being Raised in Colorado. Increased living expenses and attractions offered laborers in other occupations have caused such shortage in mine labor that operators find it expedient voluntarily to increase wages. This applies equally to operators of metal and coal mines with the difference that the former have not acted in coöperation while the latter have. On Apr. 9, twenty-two coal-mining companies, representing more than 90% of the coal mines of the state, announced a 10% raise, effective May 1 and affecting more than 12,000 men. Colorado Fuel and Iron Co. has announced a similar raise for its steel workers at the Minnequa plant, Pueblo.

BUTTE—APR. 12

Automatic Mucker has been invented by two Butte miners, Fred Salmon and Thomas Harris. These men have a patent pending for a shoveling machine that is expected to "muck" from 150 to 175 cars of rock per shift, only one man being required to handle the shovel. It may be attached to cars to receive the rock and by its own power will haul the train behind it.

No War Troubles of a violent nature are anticipated at Butte mines, notwithstanding that representatives of practically every European country now at war are living in this city. There have been patriotic demonstrations, manifesting the war spirit, and others of the opposite character. Offers of service from young and old, from students and professional men have been numerous and the women of Butte have combined to contribute their share. No visible signs of warlike conditions have as yet made their appearance, except perhaps the fact that some of the railroad companies are guarding their more important tunnels and bridges from attacks by cranks or fanatics. While the mines seem to offer a rather vulnerable spot, reliance is placed on the good sense of the miners, regardless of nationality, who on previous exciting events have always shown a spirit of loyalty to their employers when left undisturbed by professional trouble makers.

More Electrification on the Milwaukee is planned. In view of the unqualified success of electrification of nearly 400 mi. of the company's read in Montana, estimates have been prepared for extension on 300 mi. of trackage on two divisions, one about 100 mi. and the other 200 mi. The chief merits of electric haulage compared with steam haulage were enumerated by one of the company's engineers at Butte, as follows: "Less than one-third as many locomotives are required. The electrical locomotive can run indefinitely without inspection while the flues of a steam locomotive must be overhauled after a 100-mi. run. The cost of maintaining numerous terminals is abolished. Electric trains can handle heavier trains in faster time. This gives better service, gives opportunity to each train crew to do more and makes all handling costs cheaper. Water tanks and coal pockets must be maintained for the steam engines. These now are dispensed with. The thousands of cars necessary to haul the company coal now may be used for other purposes. The trouble and delay of having water tanks freeze in winter are ended. There is an enormous improvement in the service in the winter time. When it is cold, it is difficult to get up steam and to keep it up. All delays on the Milwaukee this year have been on other divisions than those electrified. Yet the electrified divisions are those where the steepest grades are encountered. The trains coast down grades without brakes, thereby regenerating electricity. Thousands of dollars in power are saved each month in this way. There are no scraping brakes to wake sleepers. There is no smoke. Train detentions are much less. Because bigger trains can be handled at a higher speed, a single track is sufficient for traffic which would require a double track on steam railways. No sparks drop from the locomotive to set fire to forests. This means a saving of thousands of dollars every year in fire claims." These satisfactory results in electrification of the steam railroad mean an added market of copper, both for transmission and for equipment.

SALT LAKE CITY—APR. 12

Tintic Milling Co.'s Expansion is about realized. The company, starting with an initial capacity of 100 tons daily, is now treating a daily average of 250 tons; within the next three weeks this will be increased to 300 tons. In the future, after the completion of certain changes, the mill will produce bullion only, instead of as at present both bullion and concentrates. A car of bullion of a value of $50,000 is being shipped to New Jersey, and a car of concentrates to a local smeltery, as announced by the company, will bring $36,000 net. The mines furnishing the greater part of the ore treated are the Iron Blossom and Dragon Consolidated.

Mobilization of Utah's Resources has been a subject of much consideration here during the last week. The local managers of the three large smelting companies operating in the Salt Lake Valley have placed themselves and their plants on record as being ready to furnish all possible aid to the government in the present war situation in the matter of the accumulation of resources, etc. Possible difficulties, which may arise, are those of labor and transportation. In the latter regard, it may be mentioned that there was, during the winter of 1917, a considerable shortage of coal, felt by large and small consumers alike, owing to transportation difficulties. It is hoped that the experience of the winter just passed will not be repeated, and that the railroads may be able, during the coming winter, to meet the demand with an adequate supply of rolling stock.

GLOBE, ARIZ.—APR. 12

An Ambulance Corps for U. S. service is being organized in Globe. Orr Woodburn, foreman of the Old Dominion first-aid and mine-rescue teams, and associates are organizing and equipping an ambulance corps which they propose to offer to the United States Government.

MORENCI, ARIZ.—APR. 12

Weekly Conferences of Employees of the Phelps Dodge subsidiary here have continued to grow in interest. The last conference was enlivened by the presence of Capt. J. P. Hodgson, consulting engineer of the mining department, whose duties are divided between all the Phelps Dodge mines. He gave an interesting talk on the standardization of rounds of holes for different faces and classes of ground. A. H. Crane, representative of the Hercules Powder Co., spoke on the applicability of powder of various strengths for different kinds of ground. The employees are deriving much benefit from these conferences.

BISBEE, ARIZ.—Apr. 12

Diversified Production at Bisbee is not the usual conception of this camp. Most people think only of copper when Bisbee is mentioned, but the district is also producing some other raw materials in important quantities. Among its other mineral products are zinc-lead shipments to Kansas City, where they enter into the manufacture of paint; silver-lead ore sent to El Paso for smelting; manganese ore shipped to Chicago; sulphides for the production at Douglas of sulphuric acid which is used principally by the New Cornelia Copper Co. at Ajo for leaching its exidized ores. In addition the Bisbee district

is shipping fluxing ores, mainly sulphides, to the Sasco, Globe and El Paso smelteries. At Calumet & Arizona's Junction shaft, there is being installed, on the 1800-ft. level, an electric pump to lift 1000 gal. of water the minute. This pump, with its 1800-ft. head, is the largest assigned to such work in this district. The pump will employ power, which is being conserved from former loss at the Douglas smeltery of the company, conveyed here over a line just completed.

OATMAN, ARIZ.—APR. 12

Vigorous Development, as well as increased milling facilities, will follow the purchase by the United Eastern Mining Co., of the Big Jim mine from the Big Jim Gold Mining Co. Payment will be made in United Eastern stock at the rate of one share for six. The United Eastern stock is to be distributed pro rata to Big Jim stockholders who also are to receive share for share in the Big Jim Consolidated, a new company which will develop the Bluebird property that endlines the United Eastern on the west. The Bluebird vein is 30 ft. wide and contains the characteristic calcite-quartz filling. The shaft is down 240 ft. and connected with the vein at 200-ft. depth; A. G. Keating who developed the Big Jim mine, will have charge of the work.

Flotation for Gold Ores is to be tried although the ores of the Oatman district are ideal for cyaniding. The high price commanded by cyanide and difficulty of securing a supply has influenced the United States Smelting, Refining and Mining Co., owning the Gold Road mine, to experiment with flotation. Tests on Gold Road ore are now being conducted for Gold Roads Mines Co. at the concentrator at Needles, Calif., 25 miles from Oatman. The Gold Road mine is equipped with a 300-ton cyanide mill.

JOPLIN, MO.—APR. 14

American Metal Co. has entered the Joplin field as an operator. Leases on 10,000 acres of land, north of the Oklahoma zinc-field development and northwest of the Joplin camp, were obtained during the last week by the American Metal Co., Ltd., from Victor Rakowsky, of Joplin. This, the largest acreage ever obtained in this field by one major company, marks the entrance of the American Metal Co. into this district as a producer; in recent years it has been purchasing from 6000 to 12,000 tons of concentrates monthly from local mines. Now it will mine and produce for itself. The lands upon which the first leases were obtained extend north and northwest of the Picher, Okla., field. The land selection was based on the progressive development along the Miami major structure and an intersection of the northwesterly extension of the Joplin mineralized belt. The deal was closed by Dr. Otto Sussman, of New York, vice president and consulting engineer of the American Metal Co. The consideration was not made public but is known to have been large, and Rakowsky maintains an interest in the project. Ten drills have been purchased and set to work on the lands.

Another Large Mining Deal was consummated during the last week when the Admiralty Zinc Co. sold its leases and three mills to Cosden, Aikens and Curtis, of Tulsa, Okla., for $600,000. The Admiralty property, which includes only a 120-acre lease south of Picher, Okla., was developed by the Century Zinc Co., about two years ago and sold to the Admiralty company just when the first concentrating plant was ready to produce. The sale price at that time was $150,000. Since then a large amount of ore has been taken from the property, and operations are said to have only been fairly started. The Tulsa buyers of the property already are heavily interested in this field, having purchased the Baltic, the McDonald, the Queen Esther and the Red Bird mines in the Webb City and Duenweg camps within the last two years. It is rumored still larger purchases are contemplated by this organization, and that they will enter the smelting end of the industry. They are oil producers and have numerous gas wells. Another big deal was that wherein the Metals Exploration Co., of New York, purchased the second lease on the Anna Beaver tract, two miles west of Picher, Okla., for $250,000. Bulkeley Wells, of Denver, is president of the Metals Exploration Co.

MELBOURNE—MAR. 10

Labor Situation, which has been growing more acute in Australia for the last decade, has been aggravated during the last two years by the activities of the Industrial Workers of the World. Australia is not only being exploited by the various laborites to such an extent that outside capital is shunning investment here, but local capital is also going to other fields because of the unsatisfactory conditions in the Commonwealth. With full control of the government in the hands of the labor party, Australia, with her government-fixed wages and hours and government-owned railways, telephone and telegraph lines, and state-owned coal mines, brick works, fisheries, bakeries and other industries, seems to be having her share of troubles besides her part in the war. A letter recently received from a Queensland bank manager expresses the existing state of affairs as follows: "There is no use in my abusing President Wilson for not resenting the many German atrocities when we here in Australia, are so callous to the suffering and sacrifices that are being made, that the whole country is now in an election turmoil—state and commonwealth fighting and haggling over petty domestic troubles of their own making—and recruiting is practically a dead letter. Bitter wrangling and jealousy between parties deprived us of even representation at the most momentous conference in the world history (Paris Conference); but what do they care? 'Billy' Hughes (Attorney General of the Commonwealth—formerly secretary of the Wharf and Dock Laborers Union) has certainly 'missed the bus.' He had his chance of proving himself a great man and a statesman. How it is all going to end is the problem. Labor has run rampant until now it will neither fight nor work and the country is fast getting hopelessly into a condition that will be soon intolerable. Two of the I. W. W. crowd have already been hanged for murder. It has steadied them a bit, but it is only for a time. When there is no more money to pay the high and extortionate wages demanded, there is going to be a lot of trouble, and I have been seriously wondering where is the best place to go, for it is about time to get out of here. There is really more prosperity here now owing to the war, than in peace times, but our raw products are not always going to be in such demand and we will never become a manufacturing country, with the labor attitude what it is." What conditions are going to prevail after the war, no one can foretell. Readjustments will have to be made in every country, but Australia has a particularly difficult time ahead. It does not portend well for Australian mining—next in importance to sheep raising.

TORONTO—APR. 14

Thamesville-Bothwell Oil Field, in which Toronto and Detroit men are interested is receiving active development. Additional drilling outfits are going into operation and the available territory has nearly all been located. The towns in the neighborhood are prepared to grant franchises if gas can be obtained, and a deep well is being put down in the hope of obtaining a supply. An active summer is anticipated.

The Mining News

ALASKA

ALASKAN COPPER SHIPMENTS to the United States in March amounted to 10,959,696 lb. contained in 17,851 tons of ore and concentrates.

ALASKA JUNEAU (Juneau)—Milling operations under way at new mill, rated nominally at 8000 tons capacity per day.

KENNECOTT COPPER CORPORATION (Kennecott)—Plans are being made for increasing the 300-ton leaching plant to 800 tons daily. Saving on Bonanza tailings now over 70%, bringing total extraction up to approximately 90%. Expect enlarged plant to be ready by autumn.

ARIZONA

Cochise County

CALUMET & ARIZONA (Douglas)—The 200-ton sulphuric-acid plant, on which work was started May 1, 1916, was completed Mar. 24 and producing at specified capacity Mar. 29. First shipment of 200 tons of 60° Bé acid sent out Apr. 1 to Ajo for New Cornelia leaching operations. A. B. Hardie was superintendent of construction.

Gila County

SUPERIOR & BOSTON (Globe)—New strike of glance ore on 100-ft. level.

OLD DOMINION (Globe)—March copper output 3,300,000 lb. Hoisting about 1000 tons daily from "A" shaft; installation of new hoist for Kingdon shaft under way.

MIAMI COPPER (Miami)—March flotation results were: Tons of feed, 127,252, averaging 1.208%; concentrates, 1664 tons, averaging 43.983%; tails averaged 0.642%. In February treated 113,639 tons averaging 1.18% recovering 1361 tons of 43.426% concentrates; tails, 0.668%.

Greenlee County

ARIZONA-CLIFTON MINES (Clifton)—New organization to develop local prospects; J. C. Gatti, president; P. Reisinger, vice-president; W. J. Riley, treasurer; L. J. Willett, secretary.

P. D. EXTENSION (Morenci)—New compressor, drills and hoist ordered; W. P. Weller, Morenci, manager.

ARIZONA COPPER (Morenci)—Down 2 days last week on account repairs in mill.

Mohave County

NEVADA-ARIZONA (Hackberry)—Good ore being taken out through Blacksmith tunnel; 50-ton mill operating one shift. T. D. Walsh, superintendent.

ARIZONA CHLORIDE (Chloride)—This company, operating the Bobby Burns mine, has started its two-compartment shaft and is installing 25-hp. Fairbanks-Morse hoist under direction of J. D. Quigley, now master mechanic. Road completed to Bay State mine, giving outlet to custom mills now under construction. F. W. Jacques, superintendent.

UNITED EASTERN (Oatman)—In March milled 6584 tons having gross value of $156,962 and yielding $150,957. Heads, $23.85 per ton; yield, $22.93; recovery nearly 96.2%. This compares well with previous results. In January, milled 3800 tons assaying $21.86 per ton; recovery 92.8%. In February, 5383 tons assaying $22.33 per ton were milled, recovery, 95.2%.

Pima County

MAGNATE COPPER (Twin Buttes)—Churn drills purchased; Walter Harvey Weed, 29 Broadway, New York, consulting engineer.

TUCSON-ARIZONA (Tucson)—Extensive underground development planned for next few months; 5% siliceous copper ore being shipped to Douglas.

NEW CORNELIA COPPER (Ajo)—Copper production expected to start this week at new 5000-ton leaching plant; carbonate ore being mined by steam shovel.

NARRAGANSETT COPPER (Vail)—This is one of the Ramsdell operations. Shipping 500 to 700 tons per month, limit of smelting contract. Employing about 175 men. Leaching plant to be built this year. Head office, 40 South Stone Ave., Tucson. W. R. Ramsdell, general manager.

Yavapai County

JEROME-MONTANA (Jerome)—This group of 29 claims, easterly, from Green Monster and Verde Combination, are to be developed by Eastern men.

JEROME-ST. LOUIS COPPER MINING CO. (Jerome)—Has installed 25-hp. Western gasoline hoisting and will add a second and third shift as soon as men can be secured; John L. Sullivan, manager.

JEROME SUPERIOR COPPER (Jerome)—Churn drill ordered in Los Angeles for this group west of the Arkansas & Arizona. Two-compartment shaft contemplated near old 270-ft. drill hole. George Mitchell, manager.

UNITED VERDE EXTENSION (Jerome)—Work is expected to be begun soon on the transportation and drainage tunnel to tap lower workings. Jerome Tunnel Co. owns 5 claims north of the "hogback" and about 1 mile from Clarkdale; this property was bought last summer by W. E. Defty who later sold one-half interest to United Verde Extension and one-half to Dundee Arizona. About 1½ miles of tunnel will be necessary to tap U. V. Extension orebody. Power line has been extended to portal site and railroad extension from Clarkdale is planned.

CALIFORNIA

Alameda County

MAGNESITE MINES in Livermore district are expected to resume work in April. Three mines developed: the Western, Hoff and Pacific. Wiltsee interests may also open manganese mines in the district.

Amador County

CONSOLIDATED AMADOR (Sutter Creek)—Heavy platform, built on top of concrete piers 32 ft. above collar of Old Eureka shaft, on a level

with new engine room, is completed. Three new 1500-hp. transformers installed. Machinery practically in readiness for change to new headframe; single-reel hoist, used in unwatering mine, will be abandoned and active development prosecuted. Some muck in bottom of shaft still but will not delay work in upper levels.

EAST EUREKA (Sutter Creek)—Reported that electrical machinery is being removed; some of it to be used by W. E. Darrow at his cyanide plant to be installed at the new stamp mill of the Argonaut. The East Eureka, or Poundstone, is on the East belt about 1 mi. east of Sutter Creek.

Butte County

CHEROKEE TAILINGS reported to have been optioned by the Guggenheim interests with a view of installing a dredge. The old Cherokee mines produced more than $10,000,000 by hydraulicking in the early days.

CHROME MINING near Pulga, on the Western Pacific, is being advanced by F. H. Stewart, who will begin hauling, as soon as roads are open for motor trucks, by way of Yankee Hill, to Oroville for rail shipment.

PARAGALIA MINING CO. (Los Angeles)—Permitted to issue 100 shares to J. A. Fairchild for purchase option from Feather River Land and Mining Co. and to sell remaining 400 shares to William R. Rowland, J. A. Fairchild and five other purchasers at par $100 per share net.

Del Norte County

CHROME PROPERTY, 25 miles northeast of Crescent City, owned by G. W. Gravlin, of Grant's Pass, Ore., will be in operation as soon as roads permit. A noteworthy feature of this ore is its platinum content; samples analyzed by the Bogardus Testing Laboratories, of Seattle, showed: Chromic oxide, 62.08%; ferrous oxide, 30.13; sulphur, 0.06; phosphorus, 0.11; silica, 5.71%; platinum, 0.04 oz. to the ton.

BRITTEN & WILSON (Waldo, Ore.)—This copper property on Patricks Creek, 17 miles southwest of Waldo, is developed by 800 ft. of tunnel and 60 ft. of shaft. Now running 500-ft. tunnel to cut vein 200 ft. below shaft. J. N. Britten, manager.

LUCKY BOY (Waldo, Ore.)—Copper mine on Shelley Creek, bonded by E. F. Helliere of Portland; crew of men getting out copper ore for shipment to Tacoma smeltery via Grants Pass as soon as roads permit. Owned by Otto Anderson of Waldo.

Mono County

SERITA (Masonic)—This mill has resumed after few months' shutdown.

PITTSBURGH (Masonic)—Leased to J. P. Conway and F. Fredericks. Shipping ore opened at 150-ft. level. S. L. Perini, manager.

Nevada County

GOLDEN CENTER (Grass Valley)—Enlarged mill and cyanide plant expected to be in operation by middle of April. Frank Vestal, mill superintendent.

CALIFORNIA (Rough and Ready)—New compressor received; new electric motor on the road. Property owned by King C. Gillette, of Los Angeles.

UNION HILL (Grass Valley)—Final payment of $80,000 on purchase price reported made by present operators. To be divided between former stockholders; about 28½c. per share after satisfying liens and ending litigation.

San Bernardino County

ATOLIA (Atolia)—Strike of miners reported and all men out. Manager Leslie gone to San Francisco for consultation with the agents. No statements available as to demands of men.

Shasta County

AFTERTHOUGHT (Ingot)—Ninety men employed. Supplies being hauled by motor trucks from Redding, 25 mi. Lumber for flotation plant to be handled by flume.

Siskiyou County

BLUE GRAVEL (Yreka)—This old drift mine, reported optioned by Oregon and Idaho men, who will install two 1200-gal. pumps. Situated on ranch of R. A. Lewis, who disposes only the mineral ground.

DEWEY (Gazelle)—Mine and mill in operation after 10-year idleness on account of high cost of fuel. Since installation of electric-power line in this region it is possible to mine the low-grade ore which did not offer sufficient profit formerly.

MT. VERNON MINING (Yreka)—Machine drills installed. Early day producer developed to 300-ft. depth. Present company drove 600-ft. tunnel at vertical depth of 900 ft. and ran 800 ft. of drifts. Situated between Greenhorn and Cherry creeks. J. S. Dobyns, of Billings, Mont., manager.

GRAY EAGLE (Happy Camp)—Annual report of Mason Valley Mines Co., controlling company, gives estimates of reserves by Orvil R. Whitaker, as of June 5, 1916, as follows: Chalcopyrite ore, 440,000 tons averaging 4.68% Cu, 0.12 oz. Ag and 0.05 oz. Au; semioxidized ore 50,000 tons averaging 5% Cu; mineralized walls, 600,000 tons, averaging 1.13% Cu; "indications" of tonnage equal to present reserves.

COLORADO

Chaffee County

IN TURRET DISTRICT, the most ambitious undertaking this season is the driving of the Mount King tunnel by P. T. Gleason of Pueblo; expected to cut veins at depth of 1500 ft. F. B. Radon, in charge of Turret Mining and Reduction Co. is drifting on high-grade gold vein and driving 250-ft. crosscut to a copper vein. Mr. Radon is also developing a 12-ft. gold-copper vein on the Mollie Gibson for William Henry and William Rodekirchen of Pueblo; also driving a tunnel for P. T. Gleason and William Henry, of Pueblo, to cut the Waverly high-grade gold vein. R. F. Stratton is shipping copper and zinc ore from the Independence and leasers are working the Sedalia copper mine.

Lake County

LEADVILLE UNIT (Leadville)—This operation of U. S. Smelting, Refining and Mining Exploration Co. has sunk Jamie Lee shaft through the quartzite on Fryer Hill and is now in white porphyry at 640 ft. Shipping regularly and employing about 75 men.

ONTARIO (Leadville)—Tunnel, being driven by Ontario, Tiger & Green Mountain Leasing Co. in Ball Moutain, has opened 4½-ft. orebody for 40 ft., about 700 ft. from portal; raise up 30 ft. still in ore. Hauling ore to Moyer siding in California Gulch. Tunnel will be continued into Tiger ground.

San Juan County

DIVES LEASING (Silverton)—Developing Shenandoah and Trilby properties in Cunningham Gulch, under direction of Daniel McLean.

ELK MINING AND MILLING (Gladstone)—Considerable development work planned for coming season. Elk tunnel will be advanced 1000 ft. by contract. Queen vein will be cut by tunnel within short distance and explored. Will install saw mill and air compressor. "Dreadnaught" drills purchased for development work. J. J. Cusick, manager.

Summit County

MICHIGAN MINING AND MILLING (Kokomo)—Shipping about 1500 tons monthly to Denver and Leadville smelteries. Recently made strike of gold-silver-lead ore in raise above tunnel level. S. H. Dunlop, manager.

TUCKER MOUNTAIN MINING AND MILLING (Kokomo)—Lessees recently opened streak of high-grade lead ore in Washington property, adjoining and under same management as the Michigan. Larger low-grade bodies have been opened during winter, and operations will be increased during coming season.

Teller County

FREE COINAGE (Altman)—This old group, adjoining the Pharmacist, Acacia and Isabella mines, has been sold to David L. Killen of Chicago.

COLORADO RARE METALS MINING AND MILLING (Colorado Springs)—Newly incorporated to investigate placer area near Woodland Park; black-sand analysis showed platinum.

CRESSON CONSOLIDATED (Cripple Creek)—Pres. A. E. Carlton reported net profit in sight on fully developed ore as of Mar. 1 was $4,003,582; cash in bank, $1,071,046; March profits, $152,316; also that development on lower levels had disclosed important orebodies.

IDAHO

Idaho County

NEW YORK MINING AND MILLING (Newsome)—Installing 10-stamp mill. Has opened 3-ft. orebody. Charles Smith, manager.

MINERAL ZONE (Elk City)—Sinking from 150-ft. level struck 9 ft. of ore; drifting on orebody. Stamp mill running full time. G. L. Baskett, owner and manager.

BLACK PINE (Elk City)—Installing machine drills. Working tunnel in 1600 ft. on 2-ft. vein. Ore bins full. Stamp mill will be started as soon as water is available. S. J. Reiben, manager.

MICHIGAN

Copper

QUINCY (Hancock)—Running into rich mass copper on lower levels, especially on the 65th level.

OLD COLONY-MAYFLOWER (Calumet)—As soon as weather permits, ground will be broken for exploratory shaft so located as to serve both mines.

FRANKLIN (Demmon)—Proceeding with its fourth installation of mechanical haulage; will use electricity instead of compressed air. System working satisfactorily.

MICHIGAN (Rockland)—Resumption of mining and hoisting expected by May 1, after enlarging of shaft is completed. Ore will be shipped to the Michigan mill.

ADVENTURE (Greenland)—Sending about 300 tons daily to Baltic mill, and an increase is expected; was formerly milled at the Winona. Twelve drills are now in operation.

NEW BALTIC (Baltic)—Sinking discontinued to timber collar of shaft; the pit will then be filled in, a temporary rockhouse built, hoist put in commission and sinking continued.

AHMEEK (Ahmeek)—Keeping up development work, about 1700 ft. each month, and also sinking at all shafts. No. 1 is 1800 ft., No. 2 below 2000-ft. level, and Nos. 3 and 4 below 3500-ft. level.

WHITE PINE EXTENSION (Pinex)—Shaft now down to 400-ft. point where plat is to be cut; this will be the third level. Crosscut will then be started to lode; now drifting on two upper levels.

VICTORIA (Victoria)—Repairs to mill not yet completed. Picking belts to be installed. In the mine, the 27th level (bottom) has shown good rock for about 50 ft.; bucket being used as track has not been extended to this level.

CALUMET & HECLA (Calumet)—March copper production of this company and subsidiaries was as follows: C. & H., 7,306,144 lb.; Ahmeek, 2,726,889; Allouez, 790,724; Centennial, 173,667; Isle Royale, 1,210,330; La Salle, 160,310; Osceola, 1,553,218; Superior, 209,960; Tamarack, 550,403; White Pine, 268,274 lb.

SOUTH LAKE (Houghton)—Shipping about 220 tons daily. Crosscut at sixth level on Butler lode disclosing same conditions as on third level; some mass copper. No. 3 of the North lodes is maintaining its average. The lodes have been holed through from level to level, thus improving the ventilation.

WINONA (Winona)—Has had trouble with its electric hoist at No. 4 shaft, and is using the steam plant while waiting for necessary repairs. Exploring underground with diamond drill in vein and in the ground on the hanging- and foot-wall sides. Recent reports indicate loss at mill of about 6 lb. copper per ton; if two-thirds of this could be reclaimed by some leaching process, it would be enough to put the mine on its feet.

MISSOURI

Joplin District

FIRST SHIPMENTS TO ATHLETIC SMELTERY at Fort Smith, Ark., have just been made, six cars of concentrates being sent from the Athletic and Wingfield-Bertha A. mines in the Webb City and Duenweg camps. One block of new smelting works now in operation.

WACO (Joplin)—Shaft sinking on newly developed site at Waco, Mo., shows 52 ft. of ore so far. P. B. Butler, manager.

CENTER CREEK (Webb City)—At annual meeting, declared regular and extra dividend totaling $65,000 for year 1916. Production is on a tract worked continuously for over 40 years. Robert F. Stewart, Webb City, manager.

COLUMBUS MINING AND DEVELOPMENT (Columbus, Kan.)—Sold leases on 2400 acres of land around Columbus to Victor Rakowsky, getting back $3000 invested in development and retaining royalty of 2½% on future developments.

WELSH (Century, Okla.)—Starting work on fourth mill, when completed, will give possible output of 600 tons weekly. At new site, ore is found at three levels. Water troubles remedied by installation of Pomona pumps.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—Operations on old slime cyanide piles will begin by end of month when it is expected hydro-electric power plant can be started again. Manager's report at first of year showed 2000 tons of $8 to $10 ore; since then new orebody estimated at 30,000 tons averaging $13 per ton has been opened, as well as several veins carrying high-grade ore.

Deer Lodge County

IN GEORGETOWN DISTRICT, work delayed by recent snowfall, has been resumed. L. E. Booth has taken charge of Donohue lease on Oro Fino ground. Montana-Reliance company has installed electric machinery for its development work. Robert Lindberg shipped two cars of high-grade ore from his claims. Venezuela properties, adjoining the Montana, are being developed by Boston men.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Trial of Minerals Separation suit for flotation-patent infringement begun Apr. 16 before Judge Bourquin in U. S. district court.

COMBINATION MINE (Butte)—This mine, on Main St., in Meaderville, a suburb of Butte, is being put in shape for active operations. Shaft, down 700 ft., is connected with East Colusa of Anaconda company. Air line from latter is being constructed to the Combination.

DAVIS-DALY (Butte)—Operating profits for February reported to be $35,000. Copper ore shipments averaging 170 tons a day—some high-grade—and 75 tons of zinc ores running from 15 to 18% zinc go to the Butte-Detroit mill. During March, 10 cars of concentrates averaging 50% zinc were made from Davis-Daly ores.

GREAT BUTTE COPPER CO. (Butte)—Sinking of Calumet shaft by company, which took over Butte & Bacorn property in extreme northern Butte district, is going on at rapid rate; shaft now down to 1400 level. Several quartz stringers encountered. Crosscutting will probably be started when 1500 level is reached.

NEVADA

Mineral County

MOGUL MINING (Rawhide)—This company has taken over Proskey Regent gold-silver properties embracing 17 claims; equipped with two shafts, hoists, compressors and drills. A. S. Proskey, in charge.

MANION-CLARK-CLIFFORD (Mina)—A 4-ft. vein of lead-silver ore has been cut by the new 30-ft. tunnel driven in the south side of this group owned by John Manion and G. W. Clark, of Tonopah, and H. M. Clifford, of Jarbidge. Old tunnel on northern side of hill will be extended.

Nye County

TONOPAH ORE PRODUCTION for the week ended Apr. 7 was 9360 tons, valued at $173,160, comparing with 9012 tons for week previous. Shippers were: Tonopah Belmont, 3030 tons; Tonopah Mining, 1900; Tonopah Extension, 2380; Jim Butler, 700; West End, 737; Rescue, 190; Halifax, 213; Montana, 102; Midway, 54; North Star, 54 tons.

WHITE CAPS (Manhattan)—West drift on fourth level 35 ft. in ore; at point where ore was encountered by drift, 396 ft. from station, crosscut has been driven 20 ft. and is still in ore.

Storey County

ANDES (Virginia)—Saved 88 cars, averaging $7.40.

UNION (Virginia)—Shipped to Mexican mill 604 tons, averaging $11.82.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Took out 158 cars of ore from Jacket surface workings and continued installation of new equipment at mill.

CON. VIRGINIA (Virginia)—Southwest drift 2700 level advanced 11 ft. in ore; total length, 150 ft., exposing 8 ft. of vein which sampled for that width $13.28 per ton. From this advance 102 cars saved averaging $12.41, shipped to Mexican mill. Ore exposed in drift a length of 80 ft. Preparing to stope and to raise to 2500 level.

NEW MEXICO

Grant County

IRON (Mogollon)—Driving crosscut tunnel on this group in southern part of district.

OAKS CO. (Mogollon)—Shipping to custom mill from both Maud S. and Clifton mines. The Deep Down property added to company's central group and 250-ft. shaft, now being retimbered, will be sunk to 500 ft.

Taos County

TAOS COPPER MINING CO. (Taos)—Preparing to reopen the old Fraser Mountain copper properties, comprising about 333 acres, 19 miles by wagon road from Taos. Former company erected mill and small smelting plant at Twining, which will probably require remodeling. Dr. A. Clarence Probert, president; John M. Bidwell, superintendent.

NEW YORK

WILLIAMS HARVEY CORPORATION (New York)—This company, in which National Lead Co. and Williams, Harvey & Co. hold control, will build a tin-smelting plant at Mill Basin on Jamaica Bay, Long Island. National Lead Co., which is a large user of tin, has long smelted tin drosses and scrap and for a year or two has been experimenting in ore smelting. Williams, Harvey & Co. are the leading tin smelters of Great Britain and have plants at Liverpool and at Hayle in Cornwall.

OREGON

Josephine County

TWO MINERS were killed by an avalanche which struck their cabin at the head of Canyon Creek. They were E. E. Lautzenhiser and D. F. Stearns, of Oatman, Ariz. Slide occurred several weeks before bodies were found.

DEEP GRAVEL (Waldo)—This placer mine has crew of men at work under direction of W. J. Wimer.

WALDO COPPER (Takilma)—Mine increasing its output and more teams are hauling ore to Waters Creek. Motor trucks may be used if sufficient teams are not available. W. B. Whipple, manager.

OSGOOD (Waldo)—This placer owned by F. H. Osgood of Seattle is being examined by H. L. Mead for New York men. Three giants are in operation; sale will depend on the showing made this season. Property comprises about 640 acres between east and west fork of Illinois River, taking its water from the east fork. Under lease to A. J. Adams for 10 years.

SOUTH DAKOTA

Lawrence County

MERRITT NO. 1 (Galena)—Borsh & Delaney, who leased this property, have first shipment of ore ready.

MERRITT NO. 2 (Galena)—Leasers making regular shipments of lead-silver ore. Grade of ore has increased within last few months and now shows, in addition to lead and silver, gold to the value of about $2.40 per ton.

MONTEZUMA AND WHIZZERS (Deadwood)—Being unwatered and put in shape for active development by J. T. Milliken, of St. Louis, who is also interested in the development at the Oro Hondo, south of the Homestake.

UTAH

Beaver County

FROM STAR DISTRICT, near Milford, shipments in March were made by the Montreal, which shipped 65 cars; Moscow, 17; and Old Hickory, 17 cars.

KING DAVID (Frisco)—Tunnel being driven under old workings, and crosscutting being done from new shaft.

MONITOR (Milford)—Sold to Joseph Pingree and D. L. Evans. Shipments for first quarter of 1917 were 46 cars, amounting to about 1840 tons. Ore carries lead, silver and gold, running $10 to $15 a ton.

Juab County

TINTIC SHIPMENTS for week ended Apr. 6 amounted to 216 cars.

EUREKA MINES (Eureka)—Initial car of 40 tons ran 23 oz. silver and 19% lead; ore came from 1250 level.

GODIVA (Eureka)—Preparing to enlarge operations. Has been worked to 1200 level, shipping chiefly from levels above 900. Productive fissure to be developed on 1200, and shaft to be sunk to greater depth.

IRON BLOSSOM (Silver City)—Dividend of 5c. a share or $50,000 payable Apr. 25; reduction from 10c. per share per quarter thought not to be permanent. Copper ore of good grade being shipped from new body.

EAGLE & BLUE BELL (Eureka)—January shipments, 55 cars; February, 62; March 99—total for quarter, 216 cars. Production for 1916, 470 cars. Mine opened to about 1850 ft. Surplus on hand end of year was $200,000; dividend of 10c. per share or $90,000 declared payable on May 1.

Salt Lake County

CARDIFF (Salt Lake)—Accumulation of 1200 to 1500 tons of ore part way down canyon at Mill B. Flat; will be hauled further as soon as roads permit. Hardly expected that mine can regularly bring normal daily tonnage of 100 tons to market before June 1. Promising new find of ore made on 400 level below tunnel level. Ore similar to main orebody, value being in lead and silver.

ALTA TUNNEL AND TRANSPORTATION (Alta)—Assessment of 1c. a share levied. Through lease, will mine Prince of Wales fissure at vertical distance from surface of 550 ft. Will thus reach own ground to west more easily as well as explore to better advantage Clements ground recently acquired.

MICHIGAN-UTAH (Alta)—Ore in Copper Prince tunnel opening satisfactorily. Ore accumulated at Tanner's Flat.

SELLS (Alta)—Drifting toward west being done 100 ft. above main-tunnel level. Ore of shipping grade in several places. Shipments awaiting better roads.

OHIO COPPER (Bingham)—Experimental flotation department at Lark mill treating 200 tons of ore daily.

BINGHAM MINES (Bingham)—Debt of $1,600,000 cleared off, and company has surplus. Owns and operates Yosemite and Commercial mines in Bingham, and controls Eagle & Blue Bell in Tintic.

UTAH COPPER (Bingham)—Has acquired Jay Gould and Alamo claims, owned by Col. E. A. Wall; cover 90 acres in Carr Fork west of steam-shovel pits.

Summit County

PARK CITY SHIPMENTS for week ended Apr. 6 were 3,689,230 lb. of ore and concentrates.

THREE KINGS (Park City)—This property in Nigger Hollow will soon have compressor installed. Work will be restricted until this is in place.

Tooele County

ENDLINE GROUP (Salt Lake)—Property in Dugway district. Hauling copper ore to Faust station, 55 miles distant on San Pedro, Los Angeles & Salt Lake R.R.

DEEP CREEK RAILROAD into Goodwin (Gold Hill, P. O.) from Wendover, which has been transporting ores for several weeks, has begun daily passenger service; trains start from Wendover at 7 a.m. every day except Sunday.

Utah County

BELEROPHON (American Fork)—In north drift, there is from 4 to 5 ft. of ore running well in silver, lead, and gold.

PACIFIC (American Fork)—In spite of snowslides, some of them deep, five teams are hauling ore from property.

ACTIVE AMERICAN FORK MINES are the Whirlwind, Mineral Flat, Pacific, Miller Hill, Belerophon, South Park, Miller, Dutchman, etc.

WISCONSIN

Zinc-Lead District

MUD RANGE (Potosi)—Minneapolis men have taken over this property, operated a few years ago by Potosi Mining and Milling Co.

GALENITE MINING (Benton)—Equipping its lead prospect at New Diggings and will open up a lower run of zinc ore proved by churn drill.

LAURENCE MINES CO. (Dubuque, Ia.)—Has taken over Lucky Twelve mine at New Diggings, formerly operated by Indian Mound Mining Co.

MUSCALUNGE DEVELOPMENT CO. (Lancaster)—New company formed by E. L. McCoy and others to develop Joseph Thomas land at Beetown.

WISCONSIN ZINC CO. (Platteville)—Birkbeck property is being dismantled and the Copeland, at Shullsburg, and the Tom Calvert, at Benton, are being equipped with mills.

CANADA

British Columbia

HEDLEY GOLD (Hedley)—Net profits in 1916 were $248,617; dividends $240,000. Reserves estimated at 311,400 tons of $9.41 ore and 87,650 tons of $6 ore. Mill changed, cyanidation now preceding concentration.

BRITISH COLUMBIA COPPER (Greenwood)—A 50-ton experimental mill has been started at company's Copper Mountain development to determine treatment plan for that ore, of which over 10,000,000 tons averaging 1.75% copper have been developed. Oscar Lachmund, manager.

GRANBY (Vancouver)—March copper production, 3,901,398 lb., of which 2,814,780 was from Anyox and 1,086,618 from Grand Forks. In January and February output was 2,946,476 and 2,580,288 lb. respectively, production being curtailed by bad weather and difficulty in getting sufficient coke.

Ontario

DAVIDSON (Porcupine)—Diamond drilling started from 300-ft. level.

DOME LAKE (Porcupine)—Capitalization increased from $2,000,000 to $3,000,000.

KERR LAKE (Cobalt)—Production during March amounted to 219,335 oz. compared with 206,474 oz. in February.

McINTYRE (Schumacher)—Gross production for March was $147,792 from 14,377 tons of ore; average value, $10.82 per ton.

MOND NICKEL (Coniston)—Smith & Durkee, of Sudbury, are understood to have the contract for deep drill exploration on the Frood Extension.

WEST DOME CONSOLIDATED (Porcupine)—Main vein on 300-ft. level, 200 ft. from shaft, widened to 10 ft. with increased gold contents. Vein has been prospected by diamond drilling.

MILLER INDEPENDENCE (Boston Creek)—New ball mill expected to be in operation early in July. Vein at bottom of 45-ft. incline shaft about 5 ft. wide with good gold contents.

KENYON COPPER MINES (Massey Station)—Gravity and flotation concentrating department enlarged; capacity now 200 tons per day. Shipments of ore and concentrates resumed.

VIPOND-NORTH THOMPSON (Porcupine)—Main shaft on North Thompson side of property timbered and station cut at 600-ft. level; crosscut at this level cut vein. Mill is treating 100 tons daily.

MEXICO

MEXICO MINES OF EL ORO (El Oro, Mex.)—Crushed in February 7300 tons, yielding $167,000; working and development expense $52,000; export tax, $8500; total, $60,500, or $8.29 per ton. Profit, $106,500.

CHILE

EXPORT TAX ON COPPER approved by Government commission appointed to investigate this proposal, according to cablegram of Apr. 17.

BETHLEHEM CHILE IRON MINES CO. (La Higuera)—Three 120-ton electric locomotives recently shipped by General Electric Co. from New York for use on the railroad from Cruz Grande harbor to Tofó iron mine.

CIA. CHILENA DE FUNDICION DE ESTANO (Arica)—Construction begun on Llallagua tin company's new smelting works. Committee of engineers in charge consists of Durward Copeland, Guillermo Yunge and Richard Gabler. Smelting company has paid up capital of $243,000. Head office, Santiago.

CHILE COPPER (Chuquicamata)—At special meeting at Wilmington, Del., stockholders voted to increase capital stock from $110,000,000 to $135,000,000 and authorized issue of $100,000,000 in bonds. Further voted to issue at once $35,000,000 convertible 6% bonds, to be offered at par to stockholders; redeemable at $110 after 1922, and convertible into common stock at $35; underwritten for 6% by syndicate, including Guggenheim Bros., Eugene Meyer, Jr., & Co. and Guaranty Trust Co.

COLOMBIA

PATO MINES, LTD. (Zaragoza)—Cleanup from dredge for 13 days ended Mar. 11 was $36,510 from 21,027 cu.yd., or over $1.73 per cu.yd. Manager W. A. Prichard writes that while unprecedented floods occurred during last rainy season and the Colombian press reported heavy damages to the Pato plant, including the breaking of the power dam, no damage resulted and there was no interruption of power service for the operation of the dredges; there have been occasional interruptions from dry spells but none from floods; dam, formerly 87 ft. in height, has been increased to 97 ft.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Apr.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
12	4.7575	73⅜	36⅝	16	4.7575	73⅜	36 9/16
13	4.7569	73⅜	36 9/16	17	4.7575	73⅜	36 9/16
14	4.7575	73⅜	36 9/16	18	4.7575	74	36¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
12	*29¼	54¾	9 @9⅛	9 @9⅛	9¼ @9⅜
13	*29	54¾	9 @9⅛	9 @9⅛	9⅛ @9⅛
14	*28½	54¾	9 @9⅛	9 @9⅛	9⅛ @9⅜
16	*28	55¼	9 @9⅛	9 @9⅛	9 @9¼
17	*27	55⅜	9 @9⅛	9 @9⅛	8⅞ @9⅛
18	*26	55½	9 @9⅛	9 @9⅛	8¾ @9

*On account of the chaotic situation in this market and the smallness of the business, done at a range of 5c. in prices according to delivery, we have appraised the market for each day, with single figures representing the average, to the best of our judgment.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Apr.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
12	136	135½	151	216¾	217	30½	55
13	136	135½	151	217	217¼	30½	55
14							
16	136	135½	149	217¾	218	30½	55
17	135	134½	147	217⅝	218	30⅜	55
18	135	134½	147	218	218	30½	55

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

NEW YORK—Apr. 18, 1917

Copper and zinc, especially the former, were conspicuously weak. Lead was dull, but strong. The volume of business done in all of these metals was relatively small.

Copper, Tin, Lead and Zinc

Copper—The outstanding feature of the week was the effort by several sellers to find a level at which buyers would contract for further supplies. Manufacturers were persistently solicited to buy, but refused to be interested in spite of the sharp concessions that were offered. In the latter part of the week, the decline gained impetus, copper for third-quarter delivery being freely offered at 27c., r.t. on the 16th, at 26c. on the 17th, and at 25c. on the 18th. There was also weakness in the near-by position, resale lots continuously appearing in the market. However, in view of the fact that the statistical position up to the middle of the year continued unimpaired, and the near-by copper that either is for sale or has to be bought is of but trifling quantity, there was not the same demoralization in this as in the market which at present is the major market, viz., for third-quarter delivery. Early in the week, some small lots of June-July copper fetched 31c., r.t., while on Apr. 16 some spot copper was sold at or about 30c. That was for a relatively small lot, and the opinion was expressed that if anybody had to sell 1000 tons he could not realize within 2c. of it. At the close, near-by copper was obtainable at 30c., while third-quarter delivery was offered at 25c.

Sales of the week were small, the bulk of the business reported being on Apr. 13 at around 27c., r.t., for third-quarter delivery.

There seems to be no doubt that domestic business has fallen off somewhat. Sometime ago many of the manufacturing plants were working on heavy rods and other heavy material, which went rapidly through the plants, producing a great output. Although the same plants are still running at full capacity, it is on a smaller kind of business which does not foot up to so large a tonnage. The railway congestion has now been cleared up, which also alters the situation. The great question at the moment is to find the price level that will interest buyers. Opinions among manufacturers differ as to the level from which a buying movement will start. Some expressed the opinion that 25c. would be the turning point, while others were more pessimistic, claiming that business was falling off materially. Those who thought that 25c. would be the turning point have seen the market go to that figure without buying developing, and the outlook is now that the market will go lower. It is the opinion among producers, however, that once a new buying movement has been developed, there will be an upward turn in prices.

Copper Sheets—No change has been reported in the situation as described last week. We continue to quote hot rolled at 42@44c. per lb., cold rolled 1c. per lb. higher. Wire is now quoted 38@40c., f.o.b. mill.

Tin—This market was very dull. The small business transacted was chiefly in future contracts.

Lead—About the same volume of business was reported as in the previous week. Some of the important producers have been reserved in their selling policy, pending negotiations with the U. S. Government. In the meanwhile, the market is stiff, with business done in April lead at 9¼@9⅜, and in May at 9⅛@9¼. Lead for delivery later than June is offered at concessions but appears to be unsalable. There were some inquiries in the market from abroad, which, however, were not filled.

Zinc—The pressure to sell continued steadily during the week. On Apr. 14 a specific attempt to check the decline was made, but with its manifest failure support was withdrawn and prices then went lower.

It is reported that the plant of the Western Spelter Co., at Henryetta, Okla., has been purchased by interests identified with the American Smelting and Refining Co.

A typographical error made our quotation for zinc at St. Louis on Apr. 9 read 9⅛@9¾c., when 9½@9¾c. were the correct figures.

Zinc Sheets—Price of zinc sheets has not been changed. Market remains at $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market remains in about the same condition as reported last week. No great demand has developed. We report no change from last week's conditions. Nominal quotation is 59@62c. per lb. for No. 1 ingots, New York.

Antimony—Spot is a little easier at 34@35c. April-May shipment from* China unchanged at 14@15c. c.i.f., New York, duty unpaid.

Cerium—Cerium alloy for safety lamps unchanged at $40 per lb. C.p. chloride at $15, and c.p. oxalate at $12 per lb.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Magnesium—Metal ingots, $3; powdered, $3 to $5.25, depending on condition and quality.

Tungsten—Metal powder, minimum 95% tungsten, $2 per lb. of tungsten content.

Selenium—$1.40 in powder, $3.25 in sticks.

Quicksilver—In face of good demand and some inquiry for export, price is off to $114@115. San Francisco reports by telegraph $117.50 steady.

Gold, Silver and Platinum

Gold—The Bank of England gold reserve, according to a report from Samuel Montagu & Co., London, Mar. 22, shows an increase of £82,335 against its note issue. Movements of gold from New York have not been of great importance.

From the New York subtreasury $250,000 has been withdrawn for shipment to Spain.

Silver—The silver market has ruled steady the past week. Buying orders for coinage by the English mint continue to absorb shipments but lack of competitive buying from India or other sources has prevented any advance in price. Supplies in London continue small as shipments from America are restricted, especially since our Government has been buying about 400,000 oz. weekly for the mint. Market closes steady at the advance to 36¾ pence in London.

Mexican dollars at New York, Apr. 12, 56⅞c.; 13, 56⅞c.; 14, 56¾c.; 16, 56¾c.; 17, 56⅞c.; 18, 56⅞c.

Platinum—Unchanged at $102½@105. Demand is reported good and business more active. The movement to restrict the use of platinum for jewelry, as a war measure, is expected to cut a figure in this market.

Platinum sales have been discontinued at all United States assay offices. The metal will be conserved for Government use. Steps have been taken by the Bureau of Mines to increase the reserve of this metal which is so necessary in the prosecution of war. Already appeals have been made to the women of the country to hold in readiness for Government purchase the platinum contained in their jewelry.

Palladium—Unchanged at $90@95.

Zinc and Lead Ore Markets

Platteville, Wis. Apr. 14—Blende, basis 60% Zn, $80 for premium ore down to $72.50 for medium grade. Lead ore, basis 80% Pb, $113 per ton. Shipments reported for the week are 3086 tons of zinc ore, 187 tons of lead ore and 629 tons of sulphur ore. For the year to date the figures are: 39,240 tons of zinc ore, 1342 tons of lead ore and 6969 tons of sulphur ore. Shipped during week to separating plants, 4357 tons of zinc ore.

Joplin, Mo., Apr. 14—Blende per ton, high $83.25; basis, 60% Zn, premium ore, $80; medium to low, $76@68; calamine, per ton, basis 40% Zn, $45@40. Average selling price, all grades of zinc, $79.75.

Lead, high, $114.40; base 80% Pb, $110@106; average selling price, all grades of lead, $113.47.

Shipments the week—blende, 9382 tons; calamine, 776 tons; lead, 1522 tons. Value, all ores the week, $962,400.

Base price offerings of blende, calamine and lead have lowered the past two weeks. Bidding on calamine today dropped to $40 for next week's delivery. As buying is a week ahead of delivery the average prices for which ore is settled each week is higher than the average base price.

The Athletic Mining and Smelting Co. made first consignments of ore from its mines to the new smeltery at Fort Smith this week, shipping six carloads.

Other Ores

Caesium Ore—Ground 25% oxide, $1 per lb.

Chrome Ore—Market active with upward tendency, though quotations are still at $1 per unit for 40% ore.

Lithium Ore—Lepidolite, 4% oxide, car lots, $35.

Strontium Ore—Price of 2c. for 95% domestic is unchanged, based on cost of production and transportation. Sulphate, minimum 95%, $40 per ton.

Thorium Ore—Price advanced (monozite sand), $55 per unit, or $275 per net ton of 5% sand.

Tungsten Ore—The market has been very active at advancing prices. We quote the opening of the week at $17@18, and at the closing, $18@20, a large business having been done at $18.

Under date of Apr. 17, Charles Hardy reports as follows: "The meeting of the tungsten producers of the United States referred to in my

last report has brought to light the fact that the present demand for tungsten ore is very considerable; that in order to meet this demand by home production, it is necessary to advance the price, thus bringing into the market again ores which it would not pay to mine at the lower figure. Shipping conditions make a reliance upon foreign importation absolutely impossible and the scarcity of freight room has already reduced the imports to a very large extent. January statistics showed imports of over 600 tons from all sources; February showed only about 350 tons, and I doubt whether the March arrivals will exceed 200 tons. The imports from South America, especially Argentina, have stopped or been heavily reduced, partly on account of the shortage of shipping space, and partly on account of contracts made by the allied governments from South America to Europe. This and the heavy sales made during the first three months of this year fully justifies an advance, and the Atolia Mining Co., no doubt the biggest producer in this country, has adopted a schedule effective May 1, fixing the price for 60% scheelite at $20 a unit, with 30c. variation up and down. No doubt, the other producers of the United States will follow this policy. Of course, it must be clearly understood that this schedule applies to good class ore; foreign ores which generally contain tin and copper, most objectional impurities, are now sold at a discount from the high-grade. $18 has been paid for foreign ores available for immediate delivery and of fairly good quality, but our market is practically bare of supplies. Sellers of ore are now holding for prices from $18@20, and at these the market is quite strong. The business transacted during the past week has again exceeded several hundred tons in the New York market alone.

Molybdenum Ore—Offerings are light. Small lots of wulfenite were sold at $2 per lb. of molybdenum content.

Antimony Ore—This ore continues scarce.

Manganese Ore—Demand is strong. Ore of 50% grade is quoted at 90c. per unit, while 85c. has actually been paid on the basis of 45%. Chemical ore is quoted at 4½@6c. per pound.

Other Minerals

(Quoted by Foote Mineral Co., Philadelphia, for car lots.)

Barytes—Crude sulphate, bleached white grade, 1¼c. per lb. Off color grade, $14 per net ton. Blanc fixe, prime white dry, 3½c. per lb.

Fluorspar—The 95% grade advanced $5 to $38; metallurgical grade, 85%, advanced $3 to $33. Imported impure grade offered at lower prices.

Magnesite—Firm at 1¼c. for Californian and 2¼c. per lb. for Grecian.

Molybdenite—Brisk demand for crude sulphide with no high-grade spot in sight and little moving except under old contracts.

Zirkite—Firm at former price of 6c. per lb. with improvement in quality to 8% ZrO_2. Zirkite cement unchanged at 8c.

Carnotite—Minimum 2% U_3O_8, $60 per unit.

Iron Trade Review

NEW YORK—Apr. 18

The steel trade is looking more closely into the influences the war situation has set in motion, that will hold prices in check, says "Iron Age." The ultimate result of the concessions made to the Government is being considered; also the effect of the fixing by the Government of prices on certain contracts which mean a loss to those who take them unless they can get steel products

PITTSBURGH—Apr. 17

The war seems to have stimulated activity in the iron and steel markets, rather than otherwise. Pig iron prices have been advancing, while bookings of steel orders, in the aggregate, are heavier to date as compared with the corresponding period last month. In point of tonnage the orders by the Government, or for Government account, are not large, and do not account for the increase in bookings. Much of the war steel, however, is wanted promptly and deliveries on other orders are accordingly disarranged. Buyers are receiving scarcely any delivery promises, but are glad to place their contracts nevertheless.

Pig Iron—The $40 price on basic iron, reported a week ago as the upper limit of the market, and done only on a small prompt tonnage, is now easily the lower limit, represent $2 advance, and there have been large sales at the price, while there is talk of still higher prices. Bessemer has sold in several small lots at $42, or $2 advance, and for this grade also higher prices are talked of. Foundry and malleable have sold rather freely at $40, a price formerly done only on prompt, and there is now no distinction as to deliveries. Local and valley furnaces have not been asked to quote on first half 1918 delivery, while on the other hand the Virginia furnaces have sold largely for that period, and the leading Virginia maker has just withdrawn quotations. We quote: Bessemer, $42; basic, $40; foundry and malleable, $40, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 17
Alaska Gold M.	8
Alaska Juneau	6½
Am. Sm. & Ref., com.	98½
Am. Sm. & Ref., pf.	112½
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B.	94
Am. Zinc	32⅜
Am. Zinc, pf.	66
Anaconda	78½
Ratoplas Min.	1⅛
Bethlehem Steel	130
Bethlehem Steel, pf.	121
Butte & Superior	43
Cerro de Pasco	35⅜
Chile Cop.	22⅜
Chino	53½
Colo. Fuel & Iron	47
Crucible Steel	61½
Dome Mines	14½
Federal M. & S.	13
Federal M. & S., pf.	38
Great Nor., ore ctf.	30½
Greene Cananea	41½
Homestake	115
Inspiration Con.	55⅛
International Nickel	41½
Kennecott	43
Lackawanna Steel	82½
Miami Copper	41½
Nat'l Lead, com.	55
National Lead, pf.	108½
Nev. Consol.	22½
Ontario Min.	5⅜
Quicksilver	2
Quicksilver, pf.	2½
Ray Con.	29⅛
Republic I. & S., com.	78⅜
Republic I. & S. pf.	102
Sloss-Sheffield	53½
Tennessee C. & C.	16½
U. S. Steel, com.	110⅛
U. S. Steel, pf.	117⅜
Utah Copper	110
Va. Iron C. & C.	68

N. Y. CURB†	Apr. 17
Big Ledge	3½
Butte & N. Y.	1⅜
Butte C. & Z.	9½
Caledonia	.68
Calumet & Jerome	1⅜
Can. Cop. Corpn.	2⅛
Carlisle	5
Con. Ariz. Sm.	1⅞
Con. Coppermines	3⅛
Con. Nev.-Utah	1/16
Emma Con.	1¼
First Nat. Cop.	2½
Goldfield Con.	.61
Goldfield Merger	.07
Granite	‡.25
Greenmonster	1 7/16
Hecla Min.	7 11/16
Howe Sound	6⅜
Jerome Verde	1⅞
Joplin Ore & Spel.	.25
Kerr Lake	4 1/16
Magma	46¼
Majestic	46¼
McKinley-Dar-Sa.	.49
Mother Lode	.34
N. Y. & Hond.	14½
Nipissing Mines	7⅜
Ohio Cop.	1 1/16
Ray Hercules	3⅜
Rochester Mines	.53
St. Joseph Lead	‡17½
Seneca	1⅞
Standard S. L.	.75
Stewart	1/16
Success	.41
Tonopah	6½
Tonopah Ex.	3⅜
Tribullion	1/16
Troy Arizona	.40
United Verde Ext.	.37
United Zinc	5½
White Knob, pf.	1⅛
White Oaks	2
Yukon Gold	1⅛

SAN FRAN.*	Apr. 17
Alta	.04
Andes	.15
Best & Belcher	.06
Bullion	.02
Caledonia	.13
Challenge Con.	.05
Confidence	.10
Con. Virginia	.13
Gould & Curry	.02
Hale & Norcross	.04
Jacket-Cr. Pt.	.04
Mexican	.15
Occidental	‡.65
Ophir	.09
Overman	.04
Savage	.04
Seg Belcher	.03
Sierra Nevada	.12
Union Con.	.33
Utah Con.	.01
Belmont	4.15
Jim Butler	.68
MacNamara	.07
Midway	.14
Mont.-Tonopah	.20
North Star	.13
Rescue Eula	.26
West End Con.	.72
Atlanta	.12
Booth	.09
Comb. Frac.	.05
D'field Daisy	.03
Florence	.20
Jumbo Extension	.40
Kewanas	.16
Nevada Packard	.44
Round Mountain	.41
Silver Pick	.13
Argo	.05
Ariz. Central	.10
Big Jim	.81½
Lazy Boy	.06
Nellie	.16
Tom Reed	2.00
United Eastern	4.62½

BOSTON EXCH.*	Apr. 17
Adventure	2¼
Ahmeek	96
Algomah	.70
Allouez	61
Ariz. Com., ctfs.	12
Arnold	.40
Bonanza	.26
Butte-Ballaklava	1
Calumet & Ariz.	76½
Calumet & Hecla	540
Centennial	19
Copper Range	60½
Daly West	1½
Davis-Daly	4½
East Butte	12½
Franklin	7
Granby	80
Hancock	15
Hedley	18
Helvetia	.35
Indiana	2½
Island Cr'k, com.	65
Isle Royale	29
Keweenaw	2½
Lake	11½
La Salle	3½
Mason Valley	5½
Mass	12¼
Mayflower	2
Michigan	3½
Mohawk	85
New Arcadian	3½
New Idria	16
North Butte	21½
North Lake	1½
Ojibway	1
Old Colony	2
Old Dominion	58½
Osceola	84½
Quincy	86
St. Mary's M. L.	78
Santa Fe	1½
Shannon	8½
Shattuck-Ariz.	25
So. Lake	3½
So. Utah	.20
Superior	11
Superior & Bost.	.5
Trinity	3½
Tuolumne	1½
U. S. Smelting	57
U. S. Smelt'g, pf.	49½
Utah Apex	2
Utah Con.	15½
Utah Metal	4½
Victoria	4
Winona	3½
Wolverine	43
Wyandot	.87

BOSTON CURB*	Apr. 17
Alaska Mines Corp.	1⅜
Bingham Mines	10½
Boston Ely	.70
Boston & Mont.	.63
Butte & Lon'n Dev.	.23
Calaveras	4
Calumet-Corbin	.01½
Chief Con.	2⅜
Cortez	.20
Crown Reserve	.30
Crystal Cop.	.80
Eagle & Blue Bell	2⅜
Houghton Copper	.99
Intermountain	1½
Iron Cap Cop., pf.	14
Mexican Metals	.30
Mines of America	1⅞
Mojave Tungsten	.34
Nat. Zinc & Lead	.50
Nevada-Douglas	1½
New Baltic	1½
New Cornelia	17½
Oneco	.50
Pacific Mines	.25
Rex Cons.	.31

SALT LAKE*	Apr. 17
Big Four	.86
Black Jack	.05⅜
Cardiff	5.75
Colorado Mining	.16½
Crown Point	.05
Daly-Judge	8.25
Empire Copper	1.50
Gold Chain	.17
Grand Central	.45
Iron Blossom	.94
Lower Mammoth	.03
May Day	.09
Moscow	.12
Prince Con.	1.17½
Seven Troughs	‡.02½
Silver-King Coal'n	2.90
Silver King Con.	3.87½
Sioux Con.	.11
So. Hecla	1.15
Uncle Sam	.03
Wilbert	.13½
Yankee	.10

TORONTO*	Apr. 17
Bailey	.05
Beaver Con.	.39
Buffalo Mines	1.10
Chambers Ferland	.11
Coniagas	3.65
La Rose	.50
Peterson Lake	.10
Right of Way	.04½
T. & Hudson Bay	40.00
Temiskaming	.50
Wettlaufer-Lor.	.06
Dome Exten.	.19
Dome Lake	.19
Foley O'Brien	.60
Hollinger	5.20
Jupiter	.30
McIntyre	1.79
Newray	1.42
Porcu. Crown	.61
Schumacher	.56
Vipond	.44
West Dome	.23

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Apr. 17
Cresson Con.	5.93⅞
Doctor Jack Pot.	.06½
Elkton Con.	.08
El Paso	.20
Gold Sovereign	.03½
Golden Cycle	2.20
Granite	.50
Isabella	.14
Mary McKinney	.24½
Portland	1.60
United Gold M.	.15½
Vindicator	.69

LONDON	Mar. 29
Alaska Mexican	£0 12s 6d
Alaska Tre'dwell	2 15 0
Burma Corp.	3 15 0
Cam & Motor	0 7 9
Camp Bird	0 5 0
El Oro	0 7 0
Esperanza	0 7 9
Mexico Mines	4 2 6
Nechi, pfd.	0 13 0
Oroville	0 16 0
Santa Ger't'dis	0 9 6
Tomboy	0 19 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415		23.709	30.662	
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895		124.319		137.389	
May	28.625		135.457		152.520	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
March	51.230		199.736	
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630		7.655		34.368	
May	7.463		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695		16.525		99.056	
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65		18.95		19.45	
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.